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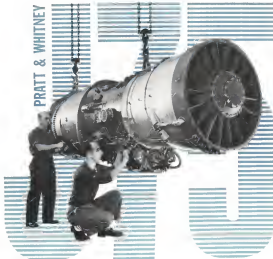
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AVIATION CALENDAR

Sept. 19-20—Rumors Aircraft Development Symposium & Flight Show, F.O.A., Springfield, Oregon; Governors and Delegates, National Governors' Association, St. Louis, Mo.

Sept. 21—Third Annual Helicopter Air Meet, Redwood Municipal Airport, Eureka, Calif.; American Society of Aeronautics and Astronautics, Washington, D.C.

Sept. 22—Regional Meeting, Airport, Los Angeles, Calif.; Ramoth, Oct. 9, Sept. 23.

Sept. 23-24—Fall Meeting, American Society of Mechanical Engineers, New York, N.Y.; Hartford, Conn.

Sept. 24-25—Fall & Winter Aircraft Design Symposium, American Society of Mechanical Engineers, New York, N.Y.

Sept. 26-27—Fifth Michigan Association of Engineers and Scientists, Detroit, Mich.; Michigan Transportation Institute, Western Michigan University, and The University of Michigan, Ann Arbor, Mich.

Sept. 28-29—North Central Regional Conference, Gulf Air Field, Fort Worth, Texas; Kansas City, Mo.

Sept. 29—Annual Meeting, American Society of Aeronautics and Astronautics, American Expedition Council, Society for Exploration, Chicago, Ill.; National Aeronautics Association, Hartford, Conn.; Los Angeles, Calif.

Sept. 30-Oct. 7—International conference on rocket and earth orbit programs for space exploration, Chicago, Ill.; American Society with Deutsches Institut für Luft- u. Nautikwissenschaften, I.T.E., San Francisco, Calif.; American Society of Mechanical Engineers, New York, N.Y.; National A.S. N.W. Study, D.C.

Oct. 2-5—National Airport Conference, University of Illinois, Urbana, Ill.; American Society of Aeronautics and Astronautics, Washington, D.C.; American Society of Mechanical Engineers, New York, N.Y.; American Society of Mechanical Engineers, New York, N.Y.

Oct. 6-8—International Northwest American Society of Aeronautics and Astronautics, Fort Worth, Texas; Fort Worth, Texas; Fort Worth, Texas; Fort Worth, Texas.

Oct. 7-8—Fall Aircraft National Electronic Conference, Alford Sherman, Chicago, Ill.

AVIATION WEEK • SEPTEMBER 14, 1997

Vol. 87, No. 3

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AVIATION CALENDAR

(Continued from page 5)

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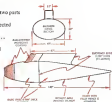
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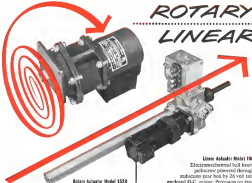
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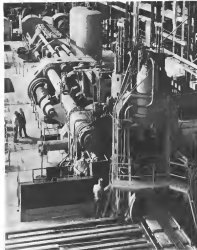
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EDITORIAL

The "Missile Industry" Myth

The United States Army is reaching a fever pitch in a vicious campaign of myth and half-truths to try to establish its dominance in the development and operational use of guided missiles.

Not since Admiral Raddford led a sub-terranean phalanx of admirals in Capitol Hill in 1949 on an abortive mission to discredit the use of atomic weapons and long range bombers has there been such a concerted campaign by one military service to advance its cause by blackening another service and the industry that serves it.

False Claims

The Army case is based on three completely false premises.

They are:

1. The guided missile, particularly in its ballistic form is simply a development of the bullet and artillery shell. Nothing could be more revealing about the technical maturity of the Army today than their advancement of this thesis. The missile in all its forms relies on the basic knowledge of aerodynamics, propulsion and guidance that has been developed and is still being developed by the aviation industry and its research agencies.

2. The Army, primarily through its former German technicians at Redstone Arsenal, possessed ballistic missile development and currently has a virtual monopoly on technical knowledge and ability in this field. We will demolish this myth in detail in later editorials. Suffice to say here that the Army technicians are dependent on and regularly use research and development data fed to them by Navy, Air Force, National Aeronautics Committee for Aeronautics and major firms in the aviation industry.

3. The Army Ordnance annual concept of weapons development can make progress in perfecting better self-sustained weapon systems such as missiles better than the combined efforts of the aviation industry, and a separate "missile industry" should be developed to produce second developed missiles.

Army Ordnance has a black record in new weapons development dating back to the Civil War, and its current performance in guns, tanks and armor development is equally unimpressive. This country applied the Army Ordnance concept of weapons development to aviation in the 1930's when government aircraft factories were opened and designs developed by one private contractor were given to other low bidders for production. Not until this policy was abandoned as a result of the Moscow Based investigation and the mass buildup of aircraft,

development and production shifted to the then infant aviation industry did our military aviation begin to rise out of the technical doldrums.

Other countries have tried the Ordnance type development philosophy with similar results. The pre-World War II French aircraft industry was nationalized and completely failed that country in its hour of crisis. The post-war British aircraft industry was plagued by a Socialist government that expelled government control to a degree that disastrously decelerated the more back-pate of the British aviation industry's technical development.

The concept of Army Ordnance developed missiles festered not for production to a satellite "missile industry" completely ignores the lessons of history and the facts of today.

There is in fact no separate "missile industry" or missile service nor is there likely to be in the future.

Missile development is a phase of aerial weapons development. As such it is an integral part of the aviation industry and its aerospace and propulsion segments. Of the 34 current missile projects under development or in production for the Army, Navy and Air Force, 12 are under the prime cognizance of aviation industry firms. The two Army projects that have been formed out from Redstone Arsenal to Chrysler Corp. for production are aviation industry propulsion and guidance systems.

Parallel Programs

Missile development today is based primarily on the research and development of the aviation industry: the National Aeronautics Committee for Aeronautics, and Air Force and Navy research agencies during the past 15 years. Development of successful missiles and sustained experience and hypersonic aircraft are parallel programs of the same basic technology not separate and unrelated fields. As one distinguished U. S. scientist put it:

"Everything that flies through the air is subject to the same laws of aerodynamics. The air doesn't care whether the vehicle traveling through it is manned or unmanned."

The attempt of the Army to force its advance aircraft philosophy on missile development and the efforts of its pamphletizing historians to organize a National Missile Industry Conference (see p. 38) smacks of hogging missile business from the aviation industry into a separate "missile industry" are doomed to failure because they are flying in the face of technological facts.

—Robert Hilde

CRYOGENICS VALVES AND PUMPS BY STRATOS



Exterior of a Stratos Cryogenic Valve



Schematic of the new Cryogenic Line Facility at Shomo, Western Canada

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Washington Roundup

Contract Cuts

USAF is dropping bids that further contract cuts will become imperative in order to complete the "big pump" contract to develop a new La Grac C-130. The Air Force's deputy chief of staff, material, says March 3 is the next milestone in a goal and that Air Force headquarters is determined it will be achieved. "Probably," he says at the expense of programs that cannot appear to after March 2 or later. "Now named program systems also must have high performance capabilities from next year to 1970-71."

Shoring within the 57 billion a year allocation for procurement and about 500 billion for development, Air Force may, will force USAF to get together about overruns. High cost will be considered in price force evidence of poor management and "so some old bomber force may be coming."

Gen. Brent is convinced the Soviet is working below capacity and that the Soviets have a determination to beat the U.S. at its own game-industrial output.

Missile Marriage

Historical and most recent meeting at the Pentagon last week was the running session of the Defense Department's defense missile committee. USAF's Maj Gen Bernard A. Schneider, Army's Maj Gen John B. Miers and William M. McInerney, special assistant to the Secretary of Defense for guided missile, report several days in the making of the IRBM problem. It is generally accepted that this will come with some kind of a marriage between USAF's Douglas built Thor and Army's Jupiter from the Redstone Arsenal.

While Army participants have expressed the opinion that Jupiter—in the line by Chrysler—can be in production in one to two months, Defense Secretary Charles E. Wilson is more conservative. He says it will take at least 18 months to get an IRBM on a production basis and then only because the IRBM is a new thing in a year of use and it's "Mighty as the Thor and Jupiter, the Secretary and will not come as serious delay. "The Secretary showed additional insight into the current missile problem with the observation that the big problem is to get a consistent weapon, not just something you can shoot once."

Homeless IRBM

Stratos and experience problem of providing launching sites for ballistic missiles was pointed out sharply by Secretary Wilson in conversation with reporters last week. Asked if there is any chance that Strategic Air Command will have an intermediate range ballistic missile within a year, Wilson snapped back, "I don't know where this idea came up if this ball was in a year."

General Confusion

Pentagon reports, in still under siege from House Government Information Subcommittee, says, which now include Civil War studies.

Editor of Army magazine an official publication scheduled 31 Jan. Under the Grant 11th review of a book by a Confederate Civil War general to the Pentagon for security review. The editor said he was about to give the book for review because it is critical of the reconstruction period, which is where it is critical of

government, and because he deemed it advisable to protect both the secretary and result in having it sent through Secretary's Review."

Pentagon closed the book. But it denied the subcommittee's request to see the files on this case and 12 others.

Assistant Secretary for Public Affairs Maria Sargent cited "separation of powers between the three major branches of the government" in the case, and asked all the way back to the president of another general—Washington—to establish precedent. Subsequently, Chairman John E. Moss (D-Calif.) and all this would be "highly" if it were not part of such a serious problem, and asked once more for a look at the files.

More Missile Misinformation

Executive administration continues to follow a delayed line about the importance of Soviet's missile force that it has successfully built "a unique long distance, atmospheric, multi-stage, ballistic missile." Defense Secretary Donald A. Quarles said in a speech last week that planning of the statement "is the first we would describe a first experimental test, not even work even a prototype of a fully developed system." In our experience, it is far from this in an occasional system. "Reports of firing of Russian ICBMs date back about five months (APR. May 1964) p. 10. Quarles also said, "We have for some time identified the Soviet with substantial progress in the long range, ballistic missile field" and "no one will not expect to be beaten in this ballistic missile race."

Keep 'In Charge of Future'

Defense Secretary Board will start a new and personal relationship with the Pentagon this week when it holds its last meeting with the Paul D. Felt. Felt is now in last week in Assistant Secretary of Defense for Research and Engineering, who will plan a quarterly session with the board now headed by Dr. Harold P. Robertson of the California Institute of Technology.

Last real session of the Board was on April 4, when the members exploded over the attitude of Felt's predecessor, Frank J. McNamara, who made it clear he would make all the decisions (APR. April 15, p. 26). Felt, in contrast, says he will depend upon the board composed of 20 top U.S. scientists "to keep us on the ball." Felt, 69-year-old, research physicist, said cryptic, was, has a strong appointment pending Congressional action on his choice. His life savings are on oil stock and he does not want to dispose of it although he is willing to sell some other securities in order to meet the needs of interest regulations. He says he has been open himself in one president in charge of the future, a definition that should please the Board.

Atlantic Charters

Supplemental air carrier and certified cargo carriers transported 9700 persons on cruise charters and 9900 persons on nonstop per capita charters since the Atlantic between Jan 1 and September. Civil Aeronautics Board says there were 112 oceanic cruise charter flights and 189 nonstop per capita charter flights in 31 of the months. Most flights were chartered by cruise ship, student groups and social organizations on vacation.

—Washington staff



VULCAN B.2 prototype shows corrected wing area, modified leading edge, curved wing tip and sweptback section of leading edge. Wing also has exhaust and three different dihedral angles.



ENGLISH ELECTRIC P.1B uses split gradient bow shock for supersonic inlet. Model shows possible Pegasus installation.



ALBION leading edges, vortex generators, are absolutely free on Götter Jumbo. They reduce drag, improve control.

Modifications on Aircraft Displayed at Farnborough



EXTERNAL LINE along rocket counter rotating probe of Vulcan B.3M.1 to fuel tanks.



SEA WISP, development of the Harrier 130, is just now replacing Royal Navy Sea Vixen fighters. All weather Vixen is armed with cannon and Phantom missiles.



FAIREY DELTA 2, drops its nose on landing. Viscidly painted experimental stretch holds offload speed record.

MILES STUDENT (below) optional observers with speed and maneuverability—cost price tag at under \$10,000 in quantity.



or the English Electric Thunderbird.

"The customer must come to us with a genuine interest before we can talk to him," commented one technician. "He's got to tell us what he wants to do, where it's located and what he believes is the threat. Then we put our people on it and come back with a proposal. We tell him what he's going to cost and quite delivery schedules."

At least three European countries are now actively engaged in talks with British missile manufacturers aimed at establishing a common meeting ground on which to talk over the problems and constraints of missile sales.

Discussing not vehicles, development travels, training missiles and the like, there is actually no missile in Britain today that could be classed as an operational weapon. These are here that are near first stage:

- **De Havilland Firebrake**, an air-to-air infrared homing missile standardized by both the Royal Navy and Royal Air Force for all carrier fighters.
- **Armstrong Whitworth Sea Skag**, an air-to-air missile with sensitive homing being developed for four guided missile ships now under construction for the Royal Navy.
- **British Bloodhound**, an anti-aircraft missile using sensitive homing and integrated into the existing radar network. Bloodhound has been ordered by the Royal Air Force.
- **English Electric Thunderbird** also an anti-aircraft missile using sensitive homing and ordered by both the British Army and the RAF.

Beyond these missiles are such test and training vehicles as the Farnham Firefish, Short Star, range of test vehicles, the Bristol Blister and British development missile, and the Vickers Type 585 air-to-air rocket which was dropped when development of its carrier, a three-engine Jetstream, was canceled.

Both Bloodhound and Thunderbird are to be sold in exactly the same form to British and foreign customers. There will be no changes in the basic missile system. Both systems are adaptable, though, and will be changes in vehicle or transporter design should a prospective customer, for example, wish to use his tanks instead of British Army standard types.

Both these missiles are also being developed beyond their present capability in the direction of more range. Based with twin fuel injectors in its Bloodhound, it is a somewhat more portable to increase range than the Thunderbird design, currently constrained to the solid propellant container in the missile.

But either Thunderbird guidance was powered by a Napier liquid propellant motor and there is a possibility that the shift back could be made to give a range increment.



ANTI-TANK MISSILE, privately developed by Vickers in Type 581, is now controlled through modified Inverness guidance system. Greater adjust mounts and elevation with flexible system, including transporter launcher (left), weighs 40 lb.



VICKERS SEA SKAG, originally named Red Lion, was air-to-air development based only through flight testing. Fixed wings, fully-controlled delta tail surfaces are typical of many of current British weapons.

BRISTOL BEEHIVE test vehicle is primarily for development of Imperial Chemical Industries' large solid-propellant booster. Double-coupled lead subcarrier rocket may be used for gathering aerodynamic data.



Missiles at Farnborough Show British Trends

ENGLISH ELECTRIC THUNDERBIRD ground-to-air missile fires in zero dynamic lift on delta (above) without booster cluster. Missile on launcher (right) includes booster. Recovery parachute air on Thunderbird test vehicle (below).





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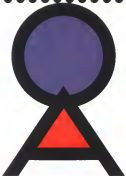
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QUETED COMET III rolls down runway (left), in four Rolls-Royce Avons fitted with bilge-pipe silencers (right).



Comet Suppressors, Feederliner Shown by British

Dr. Shefflin's Comet III was flown at Farnborough with silencers (above), designed wing leading edge containing slots to suppress head-on over wing (right). Avrocan Loudon Acousticon (below) designed to a DC-3 replacement, was displayed carrying a gas-turbine gas-turbine in its tail (below, right) for use in flight testing. Acousticon is powered by two Rolls-Royce Dart turbo-prop engines. It is available with either a long-range, eight-and-a-half-hour cruise or a short-medium range high-speed 25 knot configuration for feederliner service.



fusion with other aircraft." And, that ATC personnel should maintain, with other aircraft in the vicinity of the aircraft.

In exception to the examiner's decision, Spitzer said the committee's interpretation of the aircraft's altitude in that it can be adjusted only when it is demonstrated that immediate action was either imperative or wise.

Examiner "Uncooperative"

"The examiner goes on to reject what he terms a potential mitigator," Spitzer said. "This, of course, is a subjective and probably results in a lack of understanding of the pilot's position. The finding can be interpreted that the examiner's decision is a valid and can be utilized by the pilot only when there is an immediate necessity and in a good sense, that means until the worst has already happened."

The potential danger has no primary concern, Spitzer said. He said that as a matter of fact, witnesses at the pre-crash accident have not recalled the exact altitude of ascending west tower. Since would have been seen, if not left, trouble. He therefore ruled upon the judgment to take the corrective measures be considered necessary, Spitzer said.

Plan to Order DC-7D Canceled By American

New York-American Airlines Inc. decided plan to purchase Douglas DC-7D turboprop cargo transports, because of what it terms the "difficult" and increasing prices of the aircraft.

American President C. R. Smith announced cancellation of plans to purchase a number of these two type planes to Civil Aeronautics Board's decision regarding a 5% fee increase. In a letter to Douglas Douglas, president of Douglas Aircraft Co., Smith declared:

Airline financing has been difficult for some time. It is even more difficult now, for confidence in airline earnings and airline credit has declined substantially since the Civil Aeronautics Board issued the decision which brought about a modest increase in fees for the current. And airline credit will not be restored until the fee can be adequate rates and adequate earnings.

"The decision, therefore, has had an adverse effect on airline sales. Inductive of this is the fact that the market value of the stock of American has declined about \$4 million since the issuance of the order decision by the Board."

Other possible purchasers of the proposed turboprop cargo versions of the DC-7 include Flying Tiger Line, which

plans to buy 20 of the aircraft to be imported, and United Air Lines (UAL) Sept. 9, p. 42.

Varig Selects 707s For N.Y.-Rio Service

Rio de Janeiro-Varig Airlines of Brazil has placed a \$10 million order for three Boeing 707 turboprop aircraft plus spares. Four deliveries are scheduled in July, 1966.

Another Brazilian order, from the Brazil plan to buy four Douglas DC-8s, and a third, for two Boeing 707s, is also scheduled in July (AW Sept. 5, p. 41). Order has not yet been placed by Varig de Brazil.

The equipment plans were presented to Brazil's foreign exchange regulator, who recently granted concessions to the airlines for foreign exchange credits in the purchase.

Varig's original petition for credits covered Douglas and Viscount jetliners, but the airline switched to request for the 597 passenger Sud Aviation jet to expect to fly to Caracas to Varig, however, although less time will be available and an order for two of the French jet is now likely that the jet is originally considered. The smaller order was a "last first" according to a Sud spokesman.

Varig's 707s will be powered either by the Pratt & Whitney T44 (T75) or the Rolls-Royce Conway, bypass engine. Aircraft will be operated in de luxe New York-Rio service with a flight time of 9½ hours when half of the aircraft will be configured for the route. The jet will be in 116 passenger configuration.

Northwest, United Push For Northern Traffic

New York-Battle between United Airlines and Northwest Orient Airlines for traffic on the northern route (continental route) is being stepped up this month with introduction of new aircraft services in both carriers. Last in the competition was announced during the past 30 days.

Northwest on Sept. 1 just newly

Telephone Sales

New York-Battle between United Airlines and Northwest Orient Airlines for traffic on the northern route (continental route) is being stepped up this month with introduction of new aircraft services in both carriers. Last in the competition was announced during the past 30 days.

- United, the only line good service.
- Fly Eastern to Mexico, good service.
- Fly Northwest, good service.

delivered DC-7C equipment into a ship, New York-Battle between United Airlines and Northwest Orient Airlines for traffic on the northern route (continental route) is being stepped up this month with introduction of new aircraft services in both carriers. Last in the competition was announced during the past 30 days.

Northwest, Northwest will schedule New York-Portland, Northwest DC-7C flights with two aircraft to be scheduled Sept. 28.

Northwest's transcontinental aircraft will be flown in a new jet configuration. Starting will be scheduled. United's service will be first.

Northwest has installed a runway at its DC-7C at its New York, also offer to play the new aircraft service. The aircraft cannot will now provide the service.

Both airlines are scheduling their flights, which will be operated daily in each direction, with three times of each airline, but the airline switched to request for the 597 passenger Sud Aviation jet to expect to fly to Caracas to Varig, however, although less time will be available and an order for two of the French jet is now likely that the jet is originally considered. The smaller order was a "last first" according to a Sud spokesman.

Rail Anti-Trust Suit Reaches Appeals Court

Washington-U. S. Court of Appeals last week took under review an appeal by 42 airlines to reverse a district court ruling that railroad carriers have no liability for lost cargo in government shipments.

The suit was brought against the railroads over this year by the American Transport Air Association over what was called the "Railroad Case."

The plaintiff airlines charged that the railroad carriers' schedule of loss 10% to 15% loss, they argue, is unfair when competing with airlines for air freight business and asked \$45 million damages.

U. S. District Judge Joseph C. McCarroll, in July ruled against the railroads and held in order compensating them for continuing such practices. The amount of damages was left to be decided by a jury.

Although the suit was brought by the airlines, 26 additional carriers have now joined the case—boosting the damages asked to \$144.6 million.

Meanwhile, Congress passed legislation permitting railroads to sue airlines for the compensation, initiation and establishment of such suits. It stipulated, however, that the bill was to expire on Oct. 1 if no pending court case

Northwest Protests Eisenhower Decision

By Fred Eastman

Washington—Northwest Airlines filed suit today that there has been a sufficient number of U. S.-Oriented traffic to justify consideration of Pan American World Airways' bid to serve Seattle and Portland to the Coast Pacific route.

President Eisenhower has asked the Civil Aeronautics Board to reopen the transcontinental route case to the limited extent of defining final decision in Pan American's application (AW Sept. 9, p. 28). The report received earlier presidential approval of a CAB recommendation that PAA be denied authority to serve the two cities and parallel Northwest's Coast route.

Nyong Rebuttal

The President and it had come to his attention that there was a substantial increase in traffic between the U. S. and Tokyo. In addition, the President said, legislation granting Northwest a permanent certificate as the New York-Chicago, Minneapolis to Anchorage route would be the first of reducing the number of Northwest flights from Portland-Seattle to the Coast.

Polar Battle

Los Angeles—First American World Airways last week planned to go through with the proposal of its Polar route to Europe despite criticism over whether the route would be permitted to land at Paris destinations.

Earlier last week the French notified the State Department that Pan American might not be permitted to land at Paris while the U. S. French or agreement was required to provide Pan American to the U. S. West Coast. The route was scheduled to leave Los Angeles last February and last August.

Protesters charged the casual balance between the two countries does not meet a U. S. carrier's needs. The West Coast to Paris to the Polar route U. S. authorities said is related that the agreement allows U. S. carriers to fly from any point in the U. S. to London or Paris, while French flag carriers can fly from any point in France to specified points in the U. S.

After receiving the French terms, the State Department, Civil Aeronautics Board and airline officials adopted a new plan against yielding to the French. The State Department did indicate how, but it might be willing to consider further discussion on the French requests if France could not stand.

Northwest President Donald W. Nyong said the latest traffic figures were part of the record and available to the President.

There could be, Nyong maintained, no sharing change between Aug. 1, when President Eisenhower approved the CAB recommendation that Pan American be denied the route, and Sept. 7 when he asked that the case be reopened.

As for the New York-Chicago Minneapolis to Anchorage route, Nyong said the legislation would change the authority from temporary to permanent. Northwest Airlines has been operating this route for several months to serve the two cities and parallel Northwest's Coast route.

The latest traffic figures presented by Northwest in the case were for the 12-month period ending on last May 31.

- New York passenger sales—Northwest 19,575; Pan American 80,125.
- Revenue per mile—NWA 25.75¢, PAA 74.75¢.
- Passenger load factor—NWA 56.55%, PAA 67.75%.
- Weight load factor—NWA 67.55%, PAA 66.55%.
- Average number of passengers per trip—NWA 128, PAA 49.

Other figures presented by Pan American show that its U. S.-Oriented traffic to American flag carriers amounted to 1,354 passengers in 1965; 1,051, 1,051 in March 1966, 2,101 in September 1965 and about 2,000 in March 1967.

Pan American Petition

Pan American took exception to the Board's decision denying it ships at Seattle and Portland and filed a petition for reconsideration on the issue. The President asked the CAB to seek a new order reflecting the decision.

In its petition for reconsideration, Pan American said the Board's opinion contains an erroneous analysis of the effect such an operation would have on Northwest Airlines and of the competitive strength of the two carriers. It argued the airline offered three arguments:

- Board's estimate of diversion from Northwest of \$11 million is incorrect.
- Pan American said that by diverting some of its flights to Seattle, Portland and Anchorage, it also would divert some of its traffic over the route, thereby strengthening the North Pacific route.
- Board's analysis of relative strength and size of the two carriers is not leading to current requests Pan American said that, in deciding what to

compensate parties against Northwest's should be, there is no more reason to include Pan American's operations in Hawaii, to the South Pacific or to Alaska than there would be to those in the transatlantic or the South American routes which offer routes provide competition. Conversely, there is even less reason to exclude Northwest's domestic operations, all of which are an integral part of its transatlantic services.

Opponents failed to state the issue but which show that such service in Pan American is in the public interest. The airline and Seattle and Portland as the West Coast gateway that the most direct access to the Coast for air which comprises 55% of the nation's population and resources and which produces more than half of the traffic from the U. S. to the Orient. Because of restrictions, the business cannot be operated at all. The result of this, the airline maintained, is that both carriers, operating with substantially full capacity loads and such a cutting short of the route, will be a loss to the American air, that a substantial amount of the traffic generated by these areas during 55% of the nation's population need use the California gateway for access to the Coast.

It predicted that the only purpose in forcing these passengers against their will to divert 500 miles via the California gateway is to provide Northwest with a competitive cushion it does not need.

Subsequent to the President's approval of the decision, legislation has been passed which makes permanent Northwest's route between the New York and Seattle and Portland and Anchorage, Alaska. This route allows Northwest an additional competitive advantage of 160 miles from New York and 200 miles from Chicago over that which it enjoys en route through the Seattle gateway.

Northwest Bid Denied

In presenting Northwest's case, Nyong charged that Pan American has the strongest U. S. 10,500 miles which generates about 50% of the traffic as compared with Northwest's 30%. He also complains that the White House, having done a Board order to limit some Northwest's operations to compete for PAA's route last year.

This is the second time in less than three years the President has withheld or withdrawn in approval of the CAB's recommendation regarding a Pan American Coast Pacific route to the Coast.



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Mayors Warned Nation's Airports Lack Preparation For Jet Service

New York today's airports are well deficient in meeting the nation's aviation demands, members of the United States Conference of Mayors were told last week by H. H. Arnold.

This is true, both of facilities now available, and those being planned, the Air Transport Association's vice president, operations and engineering, told. Adequate navigation and landing aids, protected and unobstructed approach and modern, flexible airports are needed to meet aviation requirements, Arnold told the conference members, who are members of cities of 50,000 or more population.

Among the problems to be faced by communities with arrival of the jet age of commercial air transport is that of aircraft noise, a "serious consideration that cannot be overlooked," Arnold said. Noise has been an important factor in the past and will continue to increase with increasing traffic. The civil jet however will not be one of a problem that popular driven places except noisily, Arnold predicted.

We also report more complaints with the initial experience of jets because of the different pitch of the noise," the ATA official said. If the jet matter proves to be a serious problem, it will, the problem of noise insurance

will be greatly reduced," Arnold added. Another length requirement for large jets is runways, at present, most airports with liquid airports will be 10,000 ft. for mixed mode, one wind condition at sea level and 100 ft. day, Arnold said. On a 90-day day at a location 2,100 ft. above sea level, 11,500 ft. of runway will be required for maximum operation.

One method means may use to avoid such extreme requirement, Arnold told Aviation Week, is to schedule the longer flights where gross weight will approach maximum, at a time of day when temperature will be less of a factor. In one case he pointed out, most flights will not encounter such conditions at most airports. In some instances, guardrails will be cut if necessary.

More considerations will concern the size, for jets is far greater than in providing airport facilities, Arnold told the mayors. But some airport shortcomings will be more pronounced in jet operation. A deficiency in airport layout and visual aids, Arnold said, will make it poorer jet transport schedules than other facilities. An efficient system of terminal, terminals, parking areas and ramps also will be most vital for jets. Poor wind measurement of runway also will adversely affect the jet to a slightly greater extent than the propeller plane.

New Instrument Runway for Idlewild

New York-Port of New York Authority is expected to announce this month plans for construction of a new instrument runway at New York International Airport. The runway, which most probably will be added open to handle transatlantic and transcontinental jet flights despite present low on jets at Idlewild, will be 5,000 ft. long and 150 ft. out of the present runway 4,125 ft. wide at all points.

The new runway will be used in a landing runway, and approach lights to the present instrument strip will be retained to serve the new runway. The lights extend out into January Bay. The Port Authority is also working out a plan to extend the existing 5,000 ft. 4,125 to a length suitable for most commercial jet-gate operations. Negotiations with airlines are under way 700 ft. to the northeast, or head, of the runway and extending for another half mile into the bay.

Guaranteed Loan Bill Signed By President

Washington-Congressmen behind last week announced it could have memorandum to establish machinery in showing the provision of the government. Guaranteed Loan Bill signed earlier in the week by President Eisenhower.

The bill, sponsored by the Civil and Territorial Airline, is designed to aid local service and foster interest in obtaining loans with which to purchase new and modern equipment. The congress had observed that these poor financing ability made it difficult to obtain the necessary financing for new equipment without government assistance.

The act authorizes the CAA to guarantee loans of up to \$1 million on low providing that the airline is unable to secure satisfactory financing elsewhere. The government will guarantee profits from sale to, losing operations up to 90% of the purchase price of the new equipment.

A total of 25 local, territorial and interstate lines are eligible to participate in this program, according to the CAA. Application forms are expected to be ready for delivery soon.

Earlier, the President signed a bill to amend the Radioactive Act to give leasing authorities first right in taking possession of equipment, when interest in such had been made in case of bankruptcy. This bill had the backing of members of the Conference of Local Councils.



Idlewild Terminal for United

United Air Lines plans \$10 million passenger terminal at New York International Airport. Under the proposed facility is planned. Building will be 600 ft. long, 100 ft. wide, ft. of base open, features a 25 ft. overhang running the length of the building for weather protection. Financing for terminal, which will be United's largest passenger handling facility, has been arranged with Port of New York Authority under 25 yr. lease. Construction is scheduled to begin this fall with completion scheduled at June 1959.

Airline Income and Expenses—Second Quarter, 1957

In Millions

	Passenger Revenues	Mail Revenues (Net)	Property Revenues	Freight Subsidy	Other Revenues	Total Operating Revenues	Total Operating Expenses	Net Income (Before Taxes)
DOMESTIC LINES								
American	71,371,035	1,790,421	4,490,504		33,130	79,682,090	76,699,149	2,982,941
Boeing	12,725,234	329,739	111,232		14,203	13,010,408	12,686,194	324,214
Capital	16,971,946	444,120	710,813		15,322	18,132,001	17,552,471	579,530
Continental	2,547,239	123,709	317,874	17,379	519,274	3,408,200	3,447,709	35,491
Delta**	26,944,419	1,114,549	2,461,954		27,168	30,548,090	30,315,985	2,332,105
Eastern	12,131,232	260,240	735,240		33,454	13,160,166	13,037,739	1,222,427
Northwest	2,915,816	40,479	100,358	345,990	3,401	3,465,644	3,415,334	50,310
Southwest	12,845,291	484,545	1,855,493		14,493	15,189,826	15,445,734	(255,908)
TWA World	48,424,237	1,070,480	2,440,190		22,224	52,010,131	50,738,491	1,271,640
United	41,770,519	1,316,479	4,345,360		254,204	47,446,562	46,461,592	9,844,970
Western	6,244,129	123,443	375,494		9,409	6,752,075	6,615,992	1,136,083
INTERNATIONAL								
American	1,179,137	10,328	256,342		1,434,737	1,410,444	34,763	1,375,681
Boeing	1,499,310	24,760	705,247		213,761	2,439,078	1,961,587	477,491
Continental-Northwest	437,432	6,174	15,700		4,469	453,775	407,721	46,054
Eastern	756,034		20,439		2,193	758,271	812,423	(54,152)
Northwest	4,714,091	1,423,240	684,722		16,443	6,238,456	6,139,084	1,199,372
Pan American					34,323	3,430,462	3,534,768	(104,306)
Alaska	39,414,742	1,790,791	2,626,815		1,332,171	24,480,549	24,996,944	(516,395)
Latin American	17,124,418	389,207	3,444,122		800,770	21,848,517	21,857,912	(394,394)
Pacific	14,120,030	1,233,033	2,126,371	1,432	1,161,741	18,442,485	18,406,701	3,784,784
Peruair	3,452,648	107,430	668,534		24,188	4,252,800	4,910,899	(658,099)
TWA World	12,774,611	1,237,473	1,732,254		290,493	17,034,831	15,422,497	1,612,334
United	2,516,719	123,631	45,454		8,404,464	8,495,669	8,495,669	
LOCAL SERVICE								
Albuquerque	1,564,079	33,276	71,191		10,827	1,679,373	1,641,336	38,037
Boeing	473,556	8,101	18,815	167,197	17,931	608,599	570,691	37,908
Alaska	180,512	15,327	15,112		1,081,458	1,292,409	1,292,409	
Frontier	826,473	37,463	83,440		14,344	1,061,290	1,049,760	11,530
Latin Central	409,423	10,793	19,449		5,844	435,509	432,243	3,266
Midwest	1,247,187	28,210	37,127		25,711	1,338,235	1,338,235	
North Central	1,446,619	44,561	47,406		54,474	1,693,059	1,693,059	
Orchard	1,409,277	26,247	40,123		26,814	1,502,451	1,502,451	
Piedmont	824,101	34,769	14,126		12,431	1,140,427	1,140,427	
Southwest	1,566,918	39,145	60,154		22,519	1,688,736	1,688,736	
TWA World	891,729	27,714	38,320		21,542	1,079,305	1,079,305	
West Coast	467,375	11,327	18,449		6,434	1,103,585	1,091,499	12,086
AVIATION								
Boeing	1,177,246	70,173	174,843		56,820	1,480,082	1,481,034	(948)
TWA World	501,408	1,237	26,919		20,844	529,308	529,308	
CARPO LINES								
American-South American			413,126		78,556	501,682	515,331	(13,649)
Flying Tiger**								
Boeing						1,104,463	1,104,463	
Southwest & Western								
Shut								
HELICOPTER								
Chaparral Helicopters	26,419	19,284	828	104,467	519,493	565,264	565,264	
Chaparral Helicopters	41,125	13,728	19,448	127,207	5,429	109,939	109,939	
New York Airways	143,371	13,476	18,373	112,347	5,481	289,556	289,556	
ASIAN								
Alaska Airlines	403,118	140,201	317,749	904,389	244,723	1,309,259	1,309,259	
Alaska Airlines	39,174	129,214	129,214	129,214	129,214	1,309,259	1,309,259	
Continental	32,400	32,400	32,400	32,400	32,400	1,309,259	1,309,259	
Delta	124,794	124,794	124,794	124,794	124,794	1,309,259	1,309,259	
Northwest Pacific	1,400,043	1,400,043	1,400,043	1,400,043	1,400,043	1,400,043	1,400,043	

*Not available. **Delta flying for April 1957 at cost of Southeastern. Compiled by STATISTICAL WEEK from data reports to the Civil Aeronautics Board.

Shipping Buck Cuts J57 Airlift Cost

New York—Use of a relatively light weight shipping buck instead of a metal one is saving up to 50% for Boeing Airplane Co. in airlifting of J57 engines to its Seattle plant.

Flying Tiger Line, with a contract to transport 680 of the engines for Boeing's 707 production line, reports that the buck not only reduces air weight and cost less than the case, but also allows loading in the C-46, which couldn't accommodate the case.

The cargo carrier has lifted about a dozen J57's so far under the contract. It has them in C-46 directly from Pratt & Whitney's plant at East Hartford, Conn., using a truck, over to Newark Airport for DC-6A loadings.

Cost of Case

The case-type container, according to Flying Tiger, costs more than \$1,200 and weighs 3,750 lb. with 1,597 lb. engine, total weight of the shipment was 5,347 lb. At \$15 per 100 lb., cost of the shipment was \$1,042.12, or a total of \$1,242.12 including the cost of the case. The engines were by delivered and freight with its responsibility lower rate.

With the buck, which weighs 723 lb., total shipment weight is 4,700 lb. The shipment moves at the lower rate, at \$14.75 because of the reduced volume, so the cost is \$646.50. Add \$600 for the buck, and the total cost is \$1,246.50.

Flying Tiger expects the buck to cost 1958 less, depending on quantity. By using buck and delivered air weight, Boeing will save \$291.20 per engine over reduced on the shipment of an engine in a case, according to Flying Tiger's calculations. Comparison is drawn out of the comparison.

With the shipping buck system, an engine is lowered into the cradle, secured to its base and covered with a metal-type sleeve is protected. It is then lifted and lowered. Savings also apply on the return trip because the buck is lighter smaller than case.

Boeing Idea

Flying Tiger attributes the buck idea to Boeing's traffic supervisor, Les Mowbray. The cargo airline is promoting the program to other commercial and military prospects.

The airline is using the program to emphasize to military transportation officials the prospective savings in reduced packing and crating requirements in the kind of operation. Flying Tiger reports present military development of a dual type of shipping buck to reduce engine cost, but says the new plan adds usefulness and efficiency.



ENGINE IN CASE won't fit C-46 door. The container weighs 3,750 lb.



SHIPPING BUCK is lighter—723 lb.—and, with engine, fits easily into the plane.





In the only American jetliner now flying—the Boeing 707—newsmen recently flew coast-to-coast in 3 hours, 48 minutes, a new transport record. Their report on 707 jet flight: Quiet. Smooth. Exhilarating!



Around the world... across the country—jet aircraft built by Boeing are repeatedly demonstrating their advanced performance and reliability. Such demonstrations are a preview of what you can expect from the 707—America's first jet transport.

These airlines already have ordered 707s: AIR FRANCE • AIR ITALIA • AIRWAYS • BOEING • BRITISH • CONTINENTAL • DELTA • PAN AMERICAN • QUEVET • SOUTHERN • TWA

BOEING 707

SHORTLINES

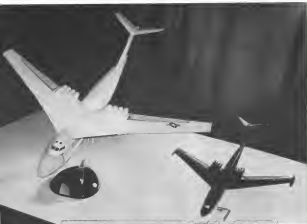
- **Argentine Air Ministry** plans to hold an international helicopter airport in Buenos Aires. A Ministry spokesman said the report will be started once the docks at a port accessible to the new area center of the city. It is to be used initially by helicopters belonging to various state organizations, including the naval and marine hospitals, and for operation of a helicopter postal service between Buenos Aires and La Plata, capital of Buenos Aires province. Later, facilities will be available for handling regular passenger and freight traffic, including service in Uruguay.
- **Mohawk Airlines** reports new company records in passengers handled and passenger miles flown. The airline handled 40,053 passengers to exceed its previous peak of 39,461 set last October. The figure represents a 27.6% increase over August, 1955. Passenger miles flown totaled 7,490,325 or compared with the previous high of 7,238,882 in June. The August record was 29,889 higher than August 1956. Annual last month was 11,153 higher than in 1956, versus 14,152, flight 82%.
- **Chadair Air Lines** set a new traffic record for itself last month by carrying 41,785 passengers, a 17% increase over August, 1956, when the airline carried 35,264 passengers. On August 18, Chadair set a record for passengers handled on a single day with 1,650. The airline will observe its seventh anniversary at a local service center on Sept. 20.
- **Trans World Airlines** last week began Lockheed 1649A jetliner service between Washington and Los Angeles. The new overnight flight has both round and fast direct air transportation. TWA began similar service between Washington and San Francisco.
- **Southern Airways** last month handled 20,140 passengers to set record for the airline in the number of passengers flown in a single month. Southern flew 3,600,000 passenger miles during August for a 20% increase over August, 1956. The airline, with offices in Atlanta, serves 13 cities and eight southern states.
- **Lake County Airlines** had a record month in August, handling 16,397 passengers throughout its system for a 25% increase over August last year. Previous high was in May when the airline handled 13,119 passengers. The latest high of 712 passengers on Aug. 25 also set a company record for a single day.

AIRLINE OBSERVER

(The following column was written by **Aviation Week Transport Editor L. L. Doty** who is attending the 11th Annual General Meeting of the International Air Transport Association in Madrid.)

- **International airlines** will take joint action next year in efforts to combat mounting costs that, so far, have no sign of abating. However, most airline officials present at the 11th annual General Meeting of IATA in Madrid last week were pessimistic over the industry's ability to stem the cost rise. In addition to increases in every category of operation, airlines have been faced with increases in landing fees and other airport charges ranging from 10 to 75% during the past year. Certain governments are threatening to impose passenger service charges. Furthermore, possibility of new charges against airlines for use of air navigation facilities on international routes is growing strongly.
- **IATA Traffic Conference** to be held next week in Miami will vote on a new show program similar to that adopted earlier this year by U.S. domestic airlines. Estimated loss to international airlines resulting from the season problem is \$25 million annually.
- **Reduced interest** by manufacturers in the transport market is evidenced by large expenditures of leading airlines, engine and avionics companies at the IATA meeting. A total of 15 companies from five countries were represented. Eleven U.S. manufacturers plus the Aircraft Industries Association were present with United Aircraft having the largest contingent—47 members.
- **Airline association** formed in Madrid by carriers operating in Spain is relative of recent move by airlines to combine efforts in the solution of local problems as a supplement to IATA activities. The 19 airlines that serve Madrid have already improved operating facilities and ground handling facilities in Spain through the association activities.
- **Watch for approval** by the IATA Miami conference on an air-sea interline agreement over North Atlantic routes. The proposal, if approved, will be subject to acceptance by shipping interests. It is designed to smooth out transfer of passenger traffic between sea and air.
- **International airlines** are showing increasing concern over the strong likelihood of a sharp loss in profits in the aircraft lease market once turbo-propowered transports appear in large numbers. When Spanish Airlines president Tomas Delgado warned that airline manufacturers may face a drop of as much as 50% in the price of the depreciable rate on many aircraft in the world market (AW, Sept. 2, p. 37).
- **IATA member airlines** have agreed to support a resolution calling for recommendations to governments that transport treaties which restrict international trade be eliminated. Specifically, the airlines want to see the end of the present policy of some governments that requires carriers to obtain liability insurance locally. Insurance costs are substantially increased when countries refuse to accept a certificate from the airline's insurers stating that the carrier's liability is fully covered.
- **Mechanical methods** for handling reservations, ticketing and fare computation on an airline basis are gaining strong support among metropolitan carriers in an unusual step toward simplifying passenger handling. Some carriers have adopted electronic data processing methods for reservations on an in-line basis but the program has not been expanded to use in-line because. Meanwhile, IATA is studying electronic computation equipment as a means of accelerating the evolution of rate proposals and amendments to rate levels.
- **Interline air structure** may come up for a complete overhaul during IATA's Miami session which will be a less complex task structure to increase efficiency and eliminate competitive abuses. It is very likely that helicopter fees may be integrated into the IATA line pattern.

AERONAUTICAL ENGINEERING



SEAMISTRESS. SeaMistress (right) models in wind note their own, then, they're compared wing, section analysis, and rule of air circuits. Right: low back is subject of various designs by Mistra to tell it as a lighter concept.

Logistic Concept Built On SeaMistress

By Evert Clark

Washington, Md.—On 15 September, the SeaMistress logistic concept (AW Sept. 2, p. 29) is based on the premise that air will be a dominant force in limited war, but the services have no modern aircraft program at present and that at least part of logistics operations for such wars should be waterborne.

Another vital premise is a time of resource is that the SeaMistress could be developed and produced in numbers within existing budget levels of high costs of extended logistic methods were assigned to make way for the quest from here.

SeaMistress essentially is an advanced, greatly enlarged version of the PGM SeaMaster, cleared up with some app

aratus of the sea rule principle and to a transport system rather than using flying or low level bombing to reach war.

Basic idea, however, is larger than simply an aircraft type. After almost five years of study, Mistra program is complete concept, with SeaMistress as the best but not the whole of the vision.

SeaMaster, although robust, is composed of a number of design variations over SeaMaster, models of the aircraft industry.

Wing Combustion

Wing obviously incorporates more complex than SeaMaster. Right jet engines are sunk in comparatively thinner wings, greatly reducing drag upon coast in bulky SeaMaster design. Sea

Master's thicker wing, large engine nacelles and broader part of fuselage all occur at approximately the same point on profile, defying the sea rule concept, which became known after PGM design was laid down.

Sharp hull demanded by SeaMaster's movement of high speeds and maneuverability at low altitudes would not be as necessary with the SeaMaster transport.

Large fuselage should give stability and maneuverability in water, and high cruising at speeds—32 ft above water level—would alleviate problems of speed, which easily outpaces jet on ground. Double-chopped bow (not jet form) also is designed to throw spray outward, lessening the chance of water entering intakes.

Elimination of need for SeaMaster's

tail turret allows stream of fuselage to move to a point entering stability and maneuverability in water.

Swivel-mounted engine nacelles in wing and tail that engine nacelles, proper wing below wing, then above should in power flow over that of the SeaMaster. Inboard nacelles also are mounted far enough out from fuselage to avoid the advantages of Coriolis effect from inboard flow.

No Tip Floats

SeaMaster model shows no wingtip floats, as in SeaMaster, probably, but cause large fuselage gives greater stability in water and become wingtips, except in rough water, would not touch surface.

Mistra emphasizes that the SeaMaster can take off and land in 10 ft waves.

PGM SeaMaster's limits are 6 ft waves. Companies also emphasize that its logistic concept calls for the SeaMaster to make great use of bays and island ports, where there is no serious problem.

Use of fresh inland waters also avoids 95% of marine fouling and corrosion problems associated with seaplanes and greatly decreases loading, unloading and maintenance problems.

In Mistra's systems plan, a base can use a U shaped dock—now available in prototype form—for its aircraft. A barge, conveniently available floating barge filled with fuel and a Strategic Air Command tanker lot.

Everything short of severe overhaul can be accomplished at these floating bases, which SeaMaster can enter, take off and drop at the site before landing, Mistra says.

Rubber Design

SeaMaster is called a "rubber design," with numerous size approximations, twice that of SeaMaster. Power plants for the first generation would be Pratt & Whitney J75 the most engines planned for the production version of the PGM. Mistra says latest design for and nuclear engines can go into the same basic scheme. Depending upon the size and number, the SeaMaster also could be built in 10-engine configuration.

Gross weight is 100 to 100 tons, again depending upon size and mission capabilities desired.

Capacity is expanded in a variety of ways—400 to 415 crew on a 3,500 mile mission, one company fully equipped, including food for three or four days, for a 500-ton ship 10 tons for a 3,500 ton cargo or 110 tons for a 1,000 ton fuel, etc.

Fueling Plans

SeaMaster could be refueled internally or by subsurface or surface tankers. Based



SEAMISTRESS could take aircraft, including, double jet or nuclear engines.



EXTRA STEP on low thrusts spray outward and away from right jet engine intakes.

SHARP STEER adds extra stability; maneuverability in water than broad-based PGM has.





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an existing petroleum supplier, Martin Schless is first of SeaMasters could run lighter aircraft into any of the 43 countries with whom the U.S. has defense commitments of England, Japan and North Africa were available to those parts.

Seaw, Sea Landings

One of these areas were lost to U.S. control, a high percentage of availability of routes to the 43 countries would still exist, based on the idea of using surface buoys that are usually about as reliable as the sea.

In addition to water landing capabilities, SeaMasters could land in four miles of water or on thick ice, Martin says.

In years of the technique of parading a few into and a 300-hp engine, less 10,000 ft. long and 300 ft. wide could be closed in (and in turn or taken at temperatures down to 400°), Martin says. Components pump out heavily the ice to provide warmer forms of water.

Sea Landing

SeaMasters might carry a crew of five plus a cargo crew of five. As much as 150 tons of cargo can be unloaded through the bow door in a matter of minutes if Martin's cargo technique of "sea trans" unloading is used. Under this concept, cargo is loaded in floating boxes in ahead and left for small

boats or helicopters in tow onto the shore.

Another possibility is self-propelled lighter units.

SeaMasters could be run onto a beach to unload, as the Convair 440 does. Reversing thrust on jet fuel of the P-51 775 jet engine would give sufficient power to back seas, Martin says.

Strategy and politics of the whole world question are much less straightforward than engineering and economics of Martin's concept.

Airfield Need

Martin charges that there is an almost unmet need for military air field, and no program for meeting the need.

It disputes the argument in some Defense circles that 900 aircraft of the Military Air Transport Service and civilian aircraft are adequate to do the job, even if all were available at once—which the company feels is highly unlikely in the event of a Korea or a large Gulf type of war.

Some of Martin's criticism on logistic needs.

• Present MATS could move 25 tons of 900 planes would require 25 days to move a shipment into a combat area in the Middle East, all but personal equipment, and could operate each of 100 aircraft in a month. Approximately 100 SeaMasters could move three



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Dust Forms Shock Wave

General one-shaped shock wave disturbance (in the present model) shown was caused by dust particles. This Schlieren photograph was taken at Cornell Aeronautical Laboratory during a study of the effect of atmospheric dust on the re-entry characteristics of space balloons under new circumstances. The shock wave collapse shown is seen in a forward. Main object of the study is to determine change in breaking side due to this pinching disturbance.

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GENCO SPECIFICATIONS	MODELS						
	KML	KML	KML	KML	KML	KML	KML
Output	200 w at 50 cps to 100 w	500 w at 50 cps to 100 w	1000 w at 50 cps to 100 w	21,000 w at 50 cps to 100 w	2000 w at 50 cps to 100 w	1000 w at 50 cps to 100 w	1000 w at 50 cps to 100 w
Frequency Range	50 to 10,000 cps at 200 w	50 to 10,000 cps at 500 w	50 to 10,000 cps at 1000 w	50 to 10,000 cps at 21,000 w	50 to 10,000 cps at 2000 w	50 to 10,000 cps at 1000 w	50 to 10,000 cps at 1000 w
Sensitivity	0.001 w at 50 cps	0.001 w at 50 cps	0.001 w at 50 cps	0.001 w at 50 cps	0.001 w at 50 cps	0.001 w at 50 cps	0.001 w at 50 cps
Distortion	2% at 200 w	1.5% at 500 w	1.5% at 1000 w	1.5% at 21,000 w	1.5% at 2000 w	1.5% at 1000 w	1.5% at 1000 w

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C-130B Three-View

Improved version of Lockheed C-130 Hercules will be offered to cargo lines. Three views shows dimensions of airplane, which will be equipped with 19.5-horsepower turbo-propellers instead of three-bladed 15 ft propeller on C-130A. (AW Sept. 2, p. 84)

division—expanding its heaviest equipment to about 15 tons, the company points out.

Ships would require 45 days to turn port 4 months.

Only 9% of combat weight—arm and small equipment—can be moved by the NATO-led means sought. The rest needs transports larger than present civil transport aircraft and larger than a medium military transport. Sea-Martin, on the other hand, could transport any class of military equipment up to and including Army's strategic convoys, Martin says. As a part of this argument, Martin cites Air Force's lack of dependent airlift capability. Douglas C-112 program was cancelled entirely and no provision made for procurement of the Douglas C-119 from Fiscal 1955 funds.

Availability of buses Sea-Martin's 15 ft stern draft high loaded marine, stable water landing area outperform land buses that accommodate large transports to 15 to 1. If Martin developed the Sea-Martin, it would attempt to reduce draft to six or six and a half feet, leaving the number of bodies of water available in decreasing low availability. Martin emphasizes that no point in Russia's land mass is more than 50 miles from a navigable water area. It has no continuous pressure on products.

Martin and it would take Russia's water, better means, experts to reach the lakes of Poland alone. Also,

planes and more could be dropped on a primary and more could be directed as, if necessary, located and. The company believes water buses are virtually unassailable.

At seven. Rate of planes needed to provide air cover over rail, road, and pipelines is five to one over that needed for the Sea-Martin system. Providing a column of air cover for 35-50 man/day for each landing area would be sufficient with Sea-Martin, and boats would be shifted every two or three days.

Storage of large, fast water-based systems. Martin advocates 25% of all troops are to be trained at any one time,

and are therefore ready for combat progress. In World War II, the company said, some 55,000 men or about four divisions—were in the transport pipeline each day. If two-thirds of the goods being shipped to front lines were concentrated between the point of entry and the front because of the slow, complex ground logistics system. Martin believes all high priority personnel and equipment must be moved by air as quickly as possible. It estimates 15% of equipment, 100% of personnel could be landed this way with an air transport fleet of reasonable size. It also believes the MALES-C-119 system would still be a place in

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one of interest and concern was the fact that, while aircraft are not under attack.

Financing

Martin's belief that development and procurement of an adequate fleet of SeaMasters can be financed within the current budget levels is based on past funding by all three services at some later stage, but an initial savings from:

- The \$80 million which Congress Department sought and was denied for financing another seaplane tender to the U. S. United States Navy and Congress plans to ask for \$100 million next year to begin construction of a seaplane and added: "Development and procurement of five prototype seaplane transports with the more funds, however, would result in a three lift capability as large as greater than that offered by a ship the size of the United States—and with the greater advantages of speed and flexibility."

- Savings in the pipeline: The 25,000 troops of sea on almost any day could be reduced to 1,000 a day in an air pipeline.

This would open the way for reducing ground forces and, therefore, the personnel budget.

- Military Sea Transport Service non appropriate from \$80 million to \$15 million annually to maintain passenger transports that are inactive but kept in a ready-duty status, Martin said. These funds could be diverted gradually to a waterborne airlift system more into being.

Shambled Block

Recent shambled block to acceptance of such a system is division of regional belief among the services, according to Martin.

USAF has budgetary and mission as responsibility for airlift but it resisted to the concept of a land-based transport vehicle.

Navy has development and procurement responsibility for seaplanes but no real logistic reason. Army and Marine Corps not only have a great and more diverse need for strategic airlift, which Air Force cannot actually provide, but have shown interest in the water-based concept, Martin says.

Martin's backing to seaplanes and alternative assistance of comparison will be extended to members of military and aggressive communities in the next session.

Military backing, which has reached top levels in at least one service, will be extended to high Defense Department levels if possible.

Martin Co. already has conducted SeaMaster hearings for some White House staff, including Rep. Gen. A. J. Goodpastor, staff secretary.

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PERFORMANCE

Military guarantees—1034 hp, 8.66 SFC—proved by official Model Tests. And these performance guarantees have been bettored in engines shipped for customer use by as much as 90 hp and 9.63 SFC! Performance? Definitely. But not at the expense of engine weight and size. For with reduction gear and ready to fly, the T58 weighs only 325 lbs., measures just 59 inches long and 54 inches in diameter. Its high power weight ratio and low SFC offer helicopters outstanding improvement in their performance and operating efficiency.



RELIABILITY

Reliability of the T58 is based on the extraordinary data being its components have demonstrated in over 4000 hours of development testing. Typical results are (1) no catastrophic failure, (2) no compressor or turbine burns, (3) no trace of compressor deterioration in official Model Tests, (4) no demonstrated effects on compressor life as a result of deliberately induced stall! Yet, this is just part of the T58's record of ruggedness. In special weather tests, the T58 demonstrated its ability to start in sub-zero temperatures and operate under severe icing conditions.



CONTROL STABILITY

To prove the stability of the T58's controls and their responsiveness to a helicopter rotor system, General Electric has subjected the T58 to over 150 hours of tests on the test stand. Despite throttle bumps and sudden collective pitch increases, the engine's control system kept power turbine speed loss to as little as 1.9%! At the same time, the gas generator and power turbine squared efficient operating speeds as fast as 4 seconds! Here, certainly, is proof that the T58 can provide extremely accurate rotor-speed command, more efficient helicopter operation.



POWER SPLITTING

The T58's excellent power splitting ability makes twin-turbine powered helicopter flight truly practical. Dual engine tests show the T58's control (1) automatically proportionates output of both engines, at any collective pitch setting, (2) allows full military power to be drawn from both engines, (3) holds power differential between engines, at all collective pitch settings, to a minimum, (4) virtually eliminates manual rotor speed adjustment, (5) prevents excessive engine or rotor speeds. General Electric Company, Section 333 & Schenectady 8, N. Y.

Rugged development test program, conducted by the Navy's BuAer and General Electric, proves T58 engine is a real "workhorse"—capable of revolutionizing helicopter flight!

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Runway Rubbish

All the debris shown here, and more—wire, dirt, nuts, bolts, paper, wood, tools, rocks, screws, springs, triggs, and junk of infinitum—ordinarily collects on airfield ramps and runways within a mere week's time—as it did at the airfield of a major aircraft manufacturer not long ago. These items were packed up laboriously by hand—as they would ordinarily have to be in the case of many shatterless items and flat-surfaced objects not subject to magnetic sweepers. But the high-powered, light-speed Frushard Cole-Vac Airfield Vacuum Cleaner gets them all—wood, in fact, into sizes 1,800 square feet of any airfield littered by such debris in 60 minutes.

Frushard Trailer Company
FRUSHARD/COLE-VAC DIVISION

Branch 35, Wichita, 35 Los Angeles 35, Calif.



Human Factors Group to Hold First Meeting

Human Factors Society of America will hold its first national meeting and simultaneous convention of the Manus Hired, Tulsa, Okla., on Sept. 25 the day preceding the Human Engineering Conference of the Office of Naval Research at the same location.

The society, which was voted into existence last October, will devote the Tulsa meeting primarily to reports of extensive consultation formal reports, two and other papers.

Areas of the society are to research and define knowledge of man-machine environment factors in all its complex forms, past and applied, to promote new and various methods of investigation of man-machine problems of supporting aircraft, designers, manufacturers and users of products and apparatus of all kinds related to man, and to encourage cooperation among these various agencies.

Comments regarding the society should be addressed to Donald T. Braden, secretary, Human Factors Society of America, P. O. Box 24637, Los Angeles 24, Calif.

Other members of the society include: President, Lawrence F. Moulton, University of California, Los Angeles; president-elect John K. Pappas, aerospace consultant, Northridge, Calif.; vice-president Arnold M. Smith, Convair San Diego Division; executive Donald W. Connor, Convair San Diego Division; and editor-in-chief Stanley Lyport, Douglas Aircraft Co., Santa Monica, Calif.

Lockheed Creates Unit For Advanced Study

Lockheed Aircraft Corp.'s California Division has created an advanced research unit in a move to develop new business.

At the same time Lockheed will undertake existing programs through a series of engineering transfer shifts.

New research unit will evaluate, study and develop aircraft systems concepts prior to preliminary design work, with R. A. Heller, chief advanced systems research engineer, in charge of the new group.

Company also created two assistant chief engineer posts, assigning them to Arthur Plack and R. L. Thoma.

Four new engineering manager posts were assigned to J. R. Donald for F-104, H. E. Jensen for F2V reconnaissance and jet trainer projects, A. J. Leary for WV-2 Nav Air and models 104H and 364H commercial transports and Lon Huey Jr., Electric Transport project.

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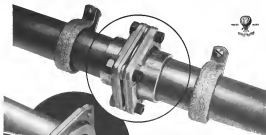
Operating Temp. (min.)	125°F -50°F	125°F -50°F	115°F -45°F	212°F -5°F	257°F -41°F	250°F -50°F
Dielectric Strength (min.)	250 volts/mil/1 mil	250 volts/mil/1 mil	300 volts/mil/1 mil	1,000 volts/mil/1 mil	1,000 volts/mil/1 mil	1,000 volts/mil/1 mil
Ins. Properties	Good	Good	Good	Excellent	Excellent	Excellent
Dimensions	2" x 12"	2" x 12"	2" x 12"	2" x 12"	2" x 12"	2" x 12"
Weight (lb./sq. ft.)	0.05	0.05	0.05	0.05	0.05	0.05
Thickness (in.)	0.005	0.005	0.005	0.005	0.005	0.005
Surface Finish	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Color	Black	Black	Black	Black	Black	Black
Application	General	General	General	General	General	General
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AVICA Ferrule/Swivel Flange connections are attached mechanically to rigid tubing using AVICA installation tools — without brazing, welding or flaring — no X-ray inspection necessary — positive lock-proof joints, that withstand severe vibration, can be made with ease in your own shop.



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Alignment of AVICA mechanically applied fittings can be controlled without difficulty due to elimination of distortion as squareness between fitting faces — a very close tolerance can also be held on overall assembly lengths.

Choice of tubing and fitting materials is no longer limited to weldable grades of aluminum and stainless steel. Full advantage can be taken of the superior strength of non-weldable grades such as 2024 (2457) aluminum.

All fuels, oils, gases and corrosive liquids can be handled by selecting the most suitable materials for tubing and fitting.

Write on company letterhead for technical data.

AVICA CORPORATION
P. O. BOX 189, NEWPORT, RHODE ISLAND



Hunter: Hunter, with guns fired out and rocket motor engine, comes in for a landing. Rocket motor is turbo-ramjet unit developed by Orbital and standardized on Sea fighter.



P.16: P.16 is shown after use on target in recent comparative assessment trials with the Hunter. Hunter P.6, Battery of 24 Orbital Sea-rocket can be seen under the wing.

Swiss Choice Narrows to Hunter, P.16

Geneva—Choice of a multi-purpose fighter to replace half the aging arsenal of Switzerland's air force now has narrowed down to the Hunter, P.6 and the Swiss P.16.

Outcome of the current series of flight and ground tests should be a no-contest decision to the Swiss government for the purchase of one of the two aircraft in a quantity of about 200. Government action is expected in the autumn session of the Bundesrat.

But the Swiss have left the door open for further evaluation of foreign types. A special commission was set up in England for the Pembroke display and will also visit Sweden, and the United States to study new developments.

lower approaches and lower landing speeds, which is an important consideration in operations from the Swiss airports. Swiss also use the P.16 in more stable as a gun platform than the Hunter.

Less Cost

The Hunter is definitely a cheaper airplane, because of its production rates compared to that of the P.16. Hundreds of Hunters have been built against a handful of P.16s.

In an F-6 version the Hunter Hunter is powered by a Rolls-Royce 600 developing max. 10,000 lb. thrust.

Grain weight of the Hunter is 17,800 lb., overall gross is 21,700 lb.

The P.16 prototype was powered by an Armstrong Siddeley Sapphire AS50A rated at 7,500 lb., but actually the engine has been changed for a later model with increased thrust. Gross weight of the P.16 is 20,100 lb. and overall gross is about 25,900 lb.

Powerful strength of the Swiss air force is about 525 fighters, of which 175 are DH Vampires, 250 are DH Vampires and 100 are North American Mustangs bought from USAF surplus. Mustangs are about 75 of the older Vampires are to be replaced.

Early Contenders

Earlier contenders for the Swiss order included the Canadian-built North American Sabre 4 and the French Dassault Mirage 4. Both these aircraft have been rejected by the Swiss.

Latest trial in the comparative testing of the Hunter and P.16 occurred last month in arranged demonstrations of both planes before the military commission of the Bundesrat. Both planes, armed with a battery of four 20 mm cannons and employing Orbital Sea-rocket—24 on the P.16 and 16 on the Hunter—were through forest tests at night in the Lake of Neuchâtel.

Difficulties with the air-control operation prevented the P.16 from achieving its rocket on one run, but otherwise the tests were excellent.

Swiss have close their little difference between the two planes on a basis of delivery and operational suitability. This, one advantage for the P.16 in its basic armament, increased load-carrying capability, and approximately 50% more fuel capacity than the Hunter. The P.16 is capable of



Vertol 44 in Sales Tour

Vertol 44 commercial version of the H-21 helicopter, here in flight from Mexico, Pa., last year, will be built in civil and military versions. V-44A has led his sales tour of officials all along the Gulf of Mexico to show national capability.

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The new Marmar Pressure Control Valve simplifies pressure regulation and relief in large sealed containers used for storage and shipping military and commercial equipment. Fitted and used air introduced into the container displaces existing atmosphere through the Marmar valve. The valve is calibrated to maintain any desired pressure. Should greater pressure differential occur, the Marmar valve returns back to the maximum desired pressure.

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PRODUCTION BRIEFING

Lockheed Aircraft Corp. in conjunction with Aeroflex Inc., Santa Clara, Calif., claims that through vacuum deposition of coatings on steel parts, its design requirements have been completely eliminated. As a result, steel with a 180,000 psi rating as high as can now be cadmium plated with no danger of hydrogen embrittlement.

Hollywood Best Tooling Co., Los Angeles, Calif., has announced the completion of what it terms the largest best tooling factory existing in the country available to private industry. The 180-ft. steel frame measures 8 ft. 7 inches in diameter x 10 ft. deep and will accommodate a robot 4 ft. 7 1/2 inches in diameter x 10 ft. 7 in. deep with an effective working area of 4 ft. 7 1/2 in. by 9 ft. The fixture will reach a temperature of 2,500° controllable to within five degrees with a vacuum of 1/10 of one micron. It is now being used to shape a large quantity of titanium which has natural hydrogen contamination and will be used for deepdrawing advanced materials as well as heat treating bearings.

Lockheed Missile Systems Division, Lockheed Aircraft Systems Co., Calif., will construct a fourth \$1,000 sq. ft. laboratory building at the Division's Palo Alto R&D center. The new lab-



oratory is next to last structure in the building program for the Missile System Division's 22 sq. acre in the San Francisco industrial park.

North American Aviation Inc. will transfer 440 machine tools from two locations to a facility which will specialise in plating, heat treating and assembly certain types of brass machining. Move involves 510 people, will be done so that no machine is idle more than 24 hr.

Materiale & Control Corp., Attleboro, Mass., asks for the first half of this year were \$19.6 million and earnings were \$1.1 million. Compared with the same period in 1950, the sales showed a 11% increase due to the growing volume of the company's jet

engine products because for the first time. The shift to jet engine work has depressed earnings 16%, according to company officials, because most machine contracts are now cost-plus-fixed fee and percent with a annual profit. However within the next year the company expects to have its machine contracts on a competitive bid, fixed price basis.

Instrument Dept., General Electric Co., Lynn, Mass., was awarded a \$1.8 mil. contract for additional MA-1 component systems. The MA-1 is designed to provide accurate over portions of the earth in the polar regions where the earth's magnetic field of the earth makes conventional magnetic compasses unreliable.

Socotec Blades from the Propulsion Division developed an anti-erosion layer for both turbine and compressor materials. The red colored layer is a complex combination of phosphorus, silicon and a wire mesh.

Silo Aircraft Co., San Diego, is, as an additional contract for fabrication of barrel stainless steel honeycombs in actual sections for Convair F-105 fuselage.

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Boston, Conn.



TWO VICKERS SUPERMARINE SCIMITARs, one with wings folded, are parked at catapults on HMS Ark Royal.



Scimitar Carries Out Deck Trials for Royal Navy Aboard Ark Royal

SCIMITAR is stationed at catapult with wings folded in the position shown (top). It made 148 takeoffs and landings in one day during trials.

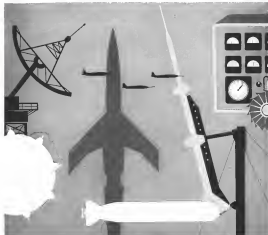


DEVELOPED as nuclear-carrier strike fighter for Royal Navy, Scimitar is powered by two Rolls-Royce Avon turboprops.



SUPERCIRCULATION, air trapped from canards and blown over upper surface of wings, lowers stalling speed for landing.





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Saengers Describe Soviet Missiles

Stuttgart—Two German rocket specialists revealed that the USSR has four long-range surface-to-surface missiles currently in production or development.

Dr. Irene Biedt-Saenger told Aviation Week that she and her husband, Dr. Eugen Saenger, have assembled detailed data on the Russian projects from conversations with scientists on both sides of the Iron Curtain as well as from published material.

According to Dr. Irene Saenger, the Russians have two intermediate range missiles—the T-2 and T-4, also known respectively as the M-109 and M-100—and two subcontinental ones—the T-3 also known as M-104, and T-4A. The T-2 was an early development type.

The recently published ICBM which the Russians fitted publicly is the T-3. According to Dr. Saenger it should go into production in 1960. Its length is 147 ft, launching weight plus booster is 550,000 lb. The engine seems to be driven by a kerosene liquid oxygen propellant producing a pressure of 42.5 to 550 lb sq in. at the burner chamber. Boost thrust is 275,000 lb. Movement speed 13,700 mph, range 5,000 mi, maximum altitude 915 mi. The missile is designed to carry a three-warhead

warhead and reportedly has another one priority among Soviet missile projects. The T-2 missile, in a two-stage missile, according to Dr. Saenger and probably in accordance with T-3, is composed of four. Dr. Saenger, who the T-2 first was tested in 1955 and since the beginning of the year has been fired at the rate of one a week. Apparently the Soviets have a stockpile of 23,000 T-2s.

The boost or road, length 95 to 125 ft, body diameter 15.2 ft, launching weight 350,000 to 387,000 lb, steel thrust 77,000 lb and booster thrust 775,000 lb. Liquid fuel is used, burning time 127 seconds, and propulsion impulse 8,380 sec./ton. Movement speed is 9,500 mph and range 1,700 mi. with maximum altitude of 490 mi.

T-3 has an altitude of 400 mi. Poland, Lachin, Manuel, Warden, R. val, all in the Baltic states—located at Scandinavia and West German—in Thuringia and East Prussia—located at 100, and Czechoslovakia—located at Germany and Western Germany.

A second Soviet ICBM, T-4A, is under construction and has been tested this year according to Dr. Saenger. It has delta wings and 1 ft in length is 59 to 69 ft, launching weight without

booster 220,000 lb. Three engines with kerosene-liquid oxygen propellant give the missile an impulse of 25,000 sec./ton. Range is between 4,000 and 10,000 mi. The T-4 stage missile will be launched New York in 69 minutes.

The fourth Soviet missile, the T-4 is 92 ft long, has a body diameter of 5.1 ft and a steel thrust of 77,000 lb. Range is 512 to 5,000 mi. This missile is based on the German A-4 and the Soviet T-1 missile.

Both the Saengers have been German rocket engineers over 20 years.

They worked at the Venera Technical University in 1935 and 1936, got a research order for the development of an intermediate range rocket booster at Tamm (North Germany) and worked there until 1942, when Hermann Goering cancelled the funds.

Their report on the intermediate range rocket booster appeared in 1944. This report was finished by the Soviet Army as well as by the U. S. Army.

The Soviets considered the Saengers important enough to send an engineering colonel, Gropin 1 class, who lives in London now, together with Stefan von Vach and the present Soviet secret police boss Ivan Stern to get the Saengers at all costs. The Russians believe

at present, the Saengers do rocket research at Stuttgart.

NEW MODEL 21 AMERICAN MECHANICAL INERTIA REEL HAS WIDE ANGLE OF INERTIA RESPONSE

An entirely new shoulder-actuated take-up reel, built and approved under Spec. MS-A-8336, Type MA-1.



1. Has unusually wide angle of inertia response. Locks throughout range of forward force selected system approximating range of positions given before force only in order point make directional-type force.
2. Can be locked either by direct or indirectly or selected in any cable movement.
3. New Inertia Sensing Mechanism provides positive locking and releasing action.
4. When reel is locked either by inertia or manually, with forward cable movement, the tension cable will retract into the reel when load is released from cable.
5. Angle of standing, with respect to longitudinal axis of reel is not exact.
6. Tension reel—12" over all. Min. reel support and control cable only 1/2" dia.
7. Manual control requires no oil, pump or any of mechanical positive port-pull control cable system. Manual operation when used on adjustable reel.
8. Uses same winding hole spacing as other reels of all standard sizes.
9. Easily serviced. Manual control cable, or reel can be replaced without disturbing other components. Pressure cable is not used to be replaced easily by service personnel.
10. Reel is suitable for your exact system work.



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WRITE FOR BOOKLET AW-557

which describes the experience, facilities and personnel of the Jet Division.



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THIS HORIZON-TO-HORIZON photo was taken recently by Model 501 lightweight tracking camera over the middle of Long Island.

From right to left can be seen Long Island Sound and Hempstead Bay, Rye Bay, Northern State Parkway, Mikhal APG, Atlantic Ocean.

Horizon-to-Horizon Camera Is Developed For Aircraft

By George L. Christen

New York—Efforts to bring aerial camera small and light enough to be carried by ultralight-type aircraft has been developed by Perkin Elmer Corp., Norwalk, Conn. The 1½-lb. camera is designed for extremely wide-angle tracking and recording.

Among its many applications are search, obstacle and velocity studies, course monitoring for navigation, terrain, geological mapping, pollution survey, exploration of unpopulated areas and highway planning.

Camera Size

Called the Model 501 Lightweight Tracking Camera, the device weighs 53 lb. fully loaded, is 7 in. thick, 17½ in. long and 15½ in. deep. It is a detector scanning device which is, below, camera's mounting surface.

The Model 501 is a scaled down version of the 1,500 lb. Thomson Precision Camera Perkin Elmer developed for the Air Force several years ago.

Model 501 uses the scanning-sensor technique to sweep an image onto the film with a continuously-rotating prism instead of using a conventional shutter. The prism is held in constant focus by an ring due to the low power of the scanning device, a wedge compensated

double-dive type equipped with means to assure uniform exposure of the film area. Focus and film data must be absolutely uniform to ensure precise reproduction of the microscopic detail required in aerial photography.

Other features of the camera's open time include:

- **Scrubbing** for both film and screen photography. When set in the overlapping pattern, good screen effects will be obtained.

- **Provision of good resolution**—all lens rays on high-speed film can be obtained in spite of the ultra-wide scan using parabolic track.

Model 501 may be set for continuous automatic operation or it may be operated manually from a turn-of-control panel on the camera staff. Provision is also made for starting and stopping the test remotely from the cockpit.

Completely Self-Contained

The precision tracking camera is a completely self-contained package. Within its cabinet is located:

- **Reel for 3,000 ft. of 16 mm film** caught by a long micro-adjustable wire over the prism just about 100 in. in exposure.

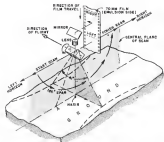
- **Image motion compensation (IMC)** which automatically increases or decreases film's speed as it varies to focus



REVERSE side of the tracking camera shows how the 1,600 ft. of 16mm film is stored and threaded from one reel to other post scanning drum, rotating prism, motor.



PERKIN-ELMER's tracking camera showing operating mechanism scanning drum.



SCHEMATIC of Model 581's optical system

motion and provide redundancy pictures.

- **Automatic autoexposure** to provide the desired exposure interval and develop.

- **Automatic exposure control** to ensure correct film exposure through the wide-angle lens has a fixed F-8.3 opening. This is accomplished with a solar cell system which automatically corrects exposure to match overall ambient illumination. Photovoltaic cells in the dome on either side of the prism provide air control input through a solenoid and follow up system. Differential speeds are taken care of by a six position range switch.

- **Automatic data recording**—A system which projects data pertinent to the exposure directly on the image for consultation purposes.

- **Fail-safe operation** which includes built-in features to prevent damage to equipment in the event of power failure, drain film or other difficulties.

General purpose includes:

- **Operation**—5 in. F-8.3 orthographic type, fixed focus type.

- **Mission**—Total system coverage, guided, coasting, low altitude, field observation.

- **Film**—Three area films: red, monochrome, clear.

- **Image**—Hyperchromaphase dome, periscope ground and pelished.

- **Format**—Angular coverage 40 deg. X 150 deg. Portside area is 2.375 X 9.425 in.

For a current installation where the plane of aim is at right angles to the direction of flight, the photographic image would be blurred since IMC not provided to compensate for the velocity

of the aircraft. IMC mechanism actually displays the local plane of aim over which the 70-amp film travels during exposure. Displacement is in a direction to cancel range movement, is synchronized with the viewing prism, and is controlled by the speed and altitude of the aircraft.

Scan rate is adjustable and can be set as fast as 2 sec.

Self-contained, constant-speed synchronization provides exposure intervals from 2-60 sec.

Outpacing to 60% is possible.

Since the camera repeatedly scans across, rather than along a plane's flight path, it records a continuous image.

Film movement is intermittent while prism notches is continuous.

OFF THE LINE

New plant was recently built by Stryker at East Waukegan, Ind., to help expedite delivery of flexible base assemblies and fittings to the East Coast.



and Middle West. The 15,000 sq. ft. facility is fully equipped to manufacture the Stryker line of products used in aircraft and industrial field, oil, hydraulic and pneumatic systems.

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RADAN is also useful for **GPS** (ground speed) of Doppler for air navigation—an advancement comparable in magnitude to the breaking of the sound barrier.

...and now for everyone

The wraps are off **RADAN**! The civilian counterpart of GPL's famous military Doppler auto-navigators, is ready and available now—for anyone and everywhere!

RADAN Systems have behind them trillions of miles of experience in transcontinental, oceanic and polar flights... save precious time and fuel... provide a priceless margin of safety.

- **RADAN**—acquires within 1% for ground speed, within 3' for drift angle.
- **RADAN**—small: 4.4 cu ft.—light: 80 lbs.
- **RADAN**—operation without ground or celestial aids.
- **RADAN**—virtually maintenance-free.



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Ground Support for Jet Aircraft



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Portable Fire Pump



Auxiliary Power for Aircraft



Turbine Drives for Pressure Pumps



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Here are nine Solar gas turbine uses! Can you think of more?

SMALL-SCALE SOLAR GAS TURBINES offer a radical new power concept for forward-looking businesses. Their easy portability, high power-to-weight ratio and reliability make them ideally suited for applications beyond the scope of conventional engines. They are easy to maintain, start instantly after long periods of inactivity and can burn a wide variety of fuels—including gasoline, kerosene, diesel oil and others.

Shown above are only nine of the many uses for these new prime movers—and additional applications are limited only by the imagination. To date more than 2000 Solar gas turbines have been sold. They are serving 35 different customers in more than 50 applications. Current production models—the 50 hp Mars® and 100 hp Jupiter®—are being turned out in volume for a growing list of satisfied military and commercial users. And development work on a new 1200 hp Saturn engine is going forward.

For more than a decade Solar has been making important contributions in the gas turbine field. Whatever your business, whatever your special power needs, perhaps a versatile Solar gas turbine can provide the answer. For a new gas turbine brochure, write to Dept. D-53, Solar Aircraft Company, San Diego 12, California. Designers, developers and manufacturers of gas turbines, expansion joints and aircraft engines, airframe and missile components.



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NEW AVIATION PRODUCTS

Gage for Guided Work

Special gage for guided work and other surface measurements checks guideway for alignment of each point with the centerline of the guideway and consistency of one point with the



be engaged for either straight reading or electronic busy, are illustrated in an evolving set of brochures.
Kelone Corp., 11500 Woodward Ave., Detroit 25, Mich.



Jet Engine Starter

Hydraulic ground-cable jet engine starter has been demonstrated to start the Vision 501 D4 helicopter at 40

sec. The P&WA 507 is 31 sec. In both cases ground cable horsepower needed was only about one third used by other systems for similar power plants the manufacturer reports.

Unit shown is fitted with a 70-hp, high-speed, air-cooled gas engine, modifications with engines from 50 hp to 250 hp are available.

Vickers, Inc., Detroit 32, Mich.



Camera Exposure System

Automatic exposure control system for still aerial and motion picture cameras provides three operating ranges, each spanning three adjacent f stops. Desired range is manually preset in relation to prevailing light and film speed. One exposure in five seconds only controlled within selected steps.

Power requirements are 11 amp at 24 v d.c. Environmental specifications comply with MIL-C-6661a from -50° to 100° F.

J. A. Moore, Inc., 5701 34th St., Long Island City, N. Y.



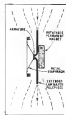
Airframe Heat Exchanger

Model RR2090 airframe electronic heat exchanger has nominal heat dissipation rate of 5,500 Btu per hour for both direct current while maintaining more than liquid surface temperature of 150° from air inlet to 20,000 ft. Maximum cooling air temperatures at this performance range are 151° at sea level and 111° at 20,000 ft. Weight is 90 lb. dry.

Lee-Hamer Division, Ltd. Inc., Elms, Ohio.

Salt Bath Cleaner

Valuetek salt bath cleans and descales for salt pans, autoclaves and



Wireless Headset

Wireless headset using ultrasonic, induction principle can be used by mounting several loops of wire around an area, feeding the coils to an audio-type receiver or microphone, amplifier and operating with the headset system or using the loop. When not connected to head gear, the winged type headset weighs 3.5 oz. Both have used the deck of cases BYAS Delco to use the system. Vision Air Transport has plans to test the installation in a DC-4 to decide the optimum loop location at a transport-type airplane. Magnetic Induction Systems, Inc., 115 Horner St., Philadelphia 15, Pa.





The spirit is still at Roosevelt Field

Thirty years ago, "The Spirit of St. Louis" took off from Roosevelt Field to initiate a new era of flight. Today, at this historic spot ARMA's creative engineering is also initiating a new era... designing and building inertial navigation systems, flight control systems, computers, automatic gun directors, and other electronic systems for the age of supersonic aircraft and missiles.

This takes imagination and exciting technology. Interested? Contact **ARMA**, Garden City, N. Y.

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AMERICAN BOSCH ARMA
CORPORATION



VICKERS helps scan new horizons...

by turning 3 tons with 13 pounds

The gun "servo", rotating atop the Lockheed Super Constellation, contains an 80-tonne roller servo. It requires a high-power-to-weight ratio driving mechanism for the rotating operation. This mechanism must be compact, dependable, able to provide constant speed regardless of load change... and operate on a positive stream from the aircraft power supply.

The small Copeland (only 11 pounds) VIKERS PACKAGE (DIVE) more than meets the drive torque needs of the large (70 feet diameter) roller. And—like similar Vickers hydro-servo units used at the Constellation for other purposes—Copeland provides dependability spanning many years of aircraft applications.

- Three components include:
- Multi-acting flow control valve maintains selected constant speed, regardless of load change
 - Slide valve for direction of motor rotation determined and speed
 - Fluid displacement hydraulic motor for driving the rollers

Based on Lockheed Constellation information (left) the servo.

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Two Ground Ejection Seats Tested In Live, Dummy Runs

Two recent demonstrations of new aircraft ejection seats are shown in these pages. Photographs above show a live ejection, made with a Bellanca Martin Baker Mark V ground level ejection seat, shots below demonstrate a North American seat tested with a dummy.

These photo sequence at upper left show Solley Hughes of the Royal Air Force being ejected in the Martin-Baker seat from a Grumman F4F-3F two seat fighter-trainer during a demonstration



at Navy's Air Test Center, Patuxent, Md. Test ranked the first time a live ground-level ejection had been performed in the U. S. and Hughes is the second man to be such an ejection.

Photos at upper left show Hughes emerging from the F4F-3F as it speeds down the runway at 120 M. At center he is about 80 ft. in the air, his parachute has deployed and he is in a full inverted position. Third picture shows Hughes landing head on the head and shocking

sequence at top right was filmed by a different camera. After the ejection, Hughes said that he felt fine.

Grumman, which plans to continue its evaluation program up to speeds of 450 M., holds a contract to install 50 of the Mark V Martin-Baker ejection seats in F4F-3F aircraft.

Shot across the bottom shows (left to right) antiaircraft dummy ejected in North American Coleman design developed ground level ejection seat.

Next photo shows seat and dummy ejected from a rocket launch-up of a T1J jet trainer. Note seat's own control rocket propellant being sent to gun altitude rapidly. Third shot shows seat's parachute fully deployed (note that the Martin-Baker seat falls over, but without a parachute) and the dummy's canopy beginning to open. Last picture shows dummy's parachute almost fully opened at top of frame, because unable at bottom of the photo.



POWER FOR THE WINGS OF THE WORLD

The brilliant new Britannia is only a part of the Bristol story



The new Bristol Brabazon — powered by 4 Bristol Proteus jet-prop engines — is seen in service on BOAC routes spanning four continents. In a matter of months she will be the first jet-prop plane in UK service on Northeast Atlantic routes.



The Bristol Proteus radial produces great power at high Mach numbers in the upper 60s. This type engine powers the Bristol Brabazon transport in air speeds rarely adopted as the standard of UK air defence.



World's first supercharged bi-prop, the new Bristol Dea delivers full take-off power at all altitudes up to 15,000 ft and at all temperatures. It is a major achievement that will have a profound influence on commercial aviation.

Another part is to be found in the design office, laboratories, and production shops of Bristol Aero-Engines Limited. Here, for nearly sixty years, Bristol designers have been producing power for the wings of the world. Power for defence. Power for civil air transport.



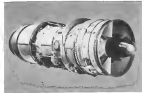
World's most economical turbine engine, built to military standards, the Proteus five turbine bi-propeller delivers 3,120 hp. It is also widely used for its flexibility of operation, simple operation and almost foolproof.



Lighter is the lightweight Dea — the Olympus, has powered the Folland Gnat, delivers more thrust for its weight than any other type-sized engine. The Olympus has been developed for lightweight fighters, trainers and executive aircraft.

BRISTOL
Aero-Engines

BRISTOL • ENGLAND



Bristol Olympus—world record-breaking turbine. The Olympus, setting the world standard for turbo-prop engines, has been in production for 15,000 hours—over 100,000 hours in total—without a single failure.



The Dea's 12-cylinder radial at 1920 was the first Bristol engine out, at the height of its long career, was long built under license at 25 different countries. The search shows how it is Bristol's.



Note: to precision-minded men at SIKORSKY

Solving the unusual problems in valve requirements demands the highest degree of creative engineering and sophisticated manufacturing skills. Examples of Tactair's ability to deliver the "unusual" are proving as numerous. First, perhaps that Tactair can do the same for you.

Case in point: the Tactair brake control valve that works equally well in either pneumatic, hydraulic or combination pneumatic-hydraulic service. These unusual characteristics make the valve ideal for "hydraulic-actuated" air rail control systems having "pneumatic-response" provisions.

Result: a precision brake valve for any service, having excellent control characteristics. Automatic "bleed" in both application and release of pressure, due to low hysteresis and friction. Fast pressure response. Low pressure drop. Smooth control of brake pressure through full range, without hunting or surging. High flow and low leakage in both actuated and released positions. The valve has a small envelope and weighs only 134 lb.

Remember: on standard or special components, we welcome the opportunity to assist you with your most precision valve problems. Every job we do is done on a personalized basis. It has been that way for 16 years. Tactair Valve Division, Aircraft Products Company, Bridgeport, Pa., BRADLEY 5-3550.



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MANAGEMENT

Missiles Force AMC Logistics Appraisal

By Claude Wilke

Wright-Patterson AFB, Ohio—USAF's Air Materiel Command sees three reasons why there must be major readjustments in its logistics to meet the impact of missile weapon systems.

• **Focus of activity** to conduct action will continue at a much faster rate at the outbreak of war than it would of the weapon systems utilized manned aircraft. Even in a state of constant combat readiness there will be no actual launching of missiles from USAF sites in peacetime.

When war starts, the logistics system must react almost from supply and maintenance for aircraft demand items to supply and maintenance for missiles at the same time.

• **Disposal of operational bases** will be left increased. Unmanned loads will be ready to go from runways and watch airfields points all of which must be left at the higher rates required to conduct. Fuel will be the major problem.

• **Determination of the best place** to store and assemble missile vehicles will be more difficult than the cost of stores carried by manned aircraft. There will be more alternatives for command and control in most sites to be left over more complicated communications links.

Such determination of the requirements to meet these needs must not be done in the near future, although AMC already has started a program of changes to take care of its missile responsibilities (AW Aug 19, p. 28 Aug. 76, p. 28). When the final approach is worked out, it is almost certain to have a profound effect on the aircraft industry from the standpoint of sales, management responsibilities and industry's role in the supply and maintenance fields.

Logistics Research Division

In order to meet the challenge in logistics and a host of related fields, AMC about a year ago created a new Logistics Research Division in the Directorate of Plans and Programs. It is headed by Col. Vincent T. Carson, so far leading a staff of only 15 persons.

In addition to an office, two annexes, there are 11 ex-laboratories, all carefully chosen for their talent and proximity to personnel from any type of related interest.

Even at this early stage, work of the Logistics Research Division merits close attention from the aircraft industry.

At USAF's part in the design, development, manufacture, distribution, maintenance and management of

weapons systems, it will most certainly feel the effect of what is done by the Logistics Research Division in performing these missions.

- Development and pursuit of a comprehensive research program in USAF logistics.
- Supervision of scientific and technical logistics research studies performed by research contractors.
- Evaluation of new and improved techniques and systems.
- Serving as AMC contact point for RAND Corp. studies.
- Coordination of research performed in AMC.

RAND, with headquarters in California, actually has been engaged in logistics studies for AMC for about five years.

Logistics Laboratory

So far, the proof has been spotty, but the research has an operation a realistic logistics system laboratory.

In the laboratory, both facilities and people are used to simulate the entire realm of data production and processing.

In operation since last October, the laboratory is now working on its first major requirement—an exercise in the logistics of a missile operation. Other companies now working on improvement of data flow and equipment are Sperry



Supersonic Voodoo Series

Three versions of the McDonnell Voodoo series fly in formation. F-301B (top left) newest version of the Air Force fighter, is a two-place fighter; F-111A (foreground), heavy air support and long on range, is designed to deliver nuclear loads and can go from side of fighter; RF-301 (right), operates as photo-reconnaissance unit with Tactair Air Command.

113 pounds cut from the Lockheed C-130!



PRESSURE COMPENSATOR, or pressure balancing bellows, applies internal duct pressure to create a force to a sealed chamber equal and opposite to the ambient pressure. It maintains a constant air seal between the duct and the bellows, preventing air from leaking out of the duct and into the aircraft cabin.

"Balanced tension" duct system uses pressure compensator built by Arrowhead



THE BLEED AIR DUCTING SYSTEM of the C-130 is a network of stainless steel tubing varying in diameter from 1/4" to 4". It performs three functions: heating, air conditioning, de-icing and preheating. Using three compressor sources, the air ranges from 360°F at 30 psig to 670°F at 145 psig.

With the ducting at an operating temperature of 670°F the expansion factor is 0.0715 for each inch of duct length. Pressure compensators were used to absorb up to 1.6 inches of growth in key locations in the 230-foot ducting system caused by the differential thermal expansion between the ducting and the supporting aircraft structure.

This system, called a "balanced tension system" greatly reduced the number, weight and complexity of ducting supports and allowed reduction in the gauge of duct walls. On the Lockheed C-130, this system actually saved 113 pounds.

For a more complete description of the system write for the new pamphlet, "Design Engineering a Balanced Tension Ducting System for the Lockheed C-130".



2266 Curry Street, Long Beach, California

Division of
Federal
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Rural and International Business Machines.

The project concerned with the impact of studies on logistics is well one of about 40 items on Col. Coover's agenda.

Priority List

In the top priority list, some of the projects of interest to the research is down include:

- **AMC under new conditions.** Determine whether the various concepts of the various aspects of AMC are consistent with each other. Analyze the degree to which AMC can assist in emergency conditions with a fast response of stocks in the nation, etc.
- **Data for top management.** Determine the types of data needed at each level to provide adequate control.
- **Engineering change control.** Develop criteria for evaluating impact of proposed engineering changes on logistics. Consider that along with operational impact in determining when to whether to adopt a proposed change. For example, the difficulty of supporting a design improvement might offset the operational advantage that would result from the change. New techniques must be developed for making engineering changes with minimum cost and time and loss of effectiveness, vulnerability and waste.
- **Initial spare parts procurement.** Analyze the entire concept of spare parts delivery, particularly in the case of gas-

crimant-based equipment when the spare may not be needed for many months following delivery of the core program. Develop criteria for setting the quantity of initial supply. Evaluate the feasibility of obtaining spares from the contractor's own stocks as long as the end item is in production. Improve the methods for estimating spare demands and saving the stock in units of parts after the initial service testing of the weapon system.

- **Maintenance of electronic equipment.** Analyze the factors that require USAF capability to maintain electronic gear. Study the possibility of redesigning to improve maintainability. Seek better programs to train, train and return personnel. One suggestion in this area would be to train men while they are on duty but planning on active duty.
- **Recording and reporting of data.** Seek new, rapid techniques and equipment that can be used by troops, contractors, depots, investigators and other services. Exchanges should aim at fast transmission with minimum of personnel, maximum accuracy. Coordinate contractor data processing systems with those of AMC. Analyze maintenance of records to seek the most efficient system.
- **Vulnerability.** Develop techniques for determining relative vulnerability of different logistics systems with attention to their costs and personnel effectiveness.
- **Distribution.** Develop techniques for



SAC Commander B-58

Col. Thomas S. Pover, new commander of the Strategic Air Command, checking out the controls of Coover's B-58. He later made a short demonstration flight to help in the evaluation of the B-58 test program.

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Sections on aircraft, missiles, avionics, supporting equipment, missile systems and airline and airport equipment will contain over 50,000 manufacturers' product listings. Latest Air Force, Army and Navy and Airline procurement practices — where to go, when to go — will be reported in characteristic AVIATION WEEK detail. Special features will include a manufacturers' index, an all-inclusive product index and a comprehensive listing of aviation distributors. These together with many other features make the greatest possible year-long value for the 1958 BUYERS' GUIDE.

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AVIATION
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Now

Alcoa offers strong, thin-wall precision castings

70 pounds saved in new interceptor fuel system

Aviation engineers have found that exterior aerodynamic requirements and internal space limitations transform today's jet aircraft fuel system into a planner's nightmare. Necessarily large orifices and tortuous passages through and around other systems components reintroduced the addition of scores of elbows and connecting fittings to supply a constant flood of fuel to the power

plant. Until now, each additional fitting carried an undesirable weight penalty.

Now, thanks to new Alcoa precision casting technology, the first jet fuel system fittings used by one major aircraft company weigh 30% less than they formerly did as steel castings. They perform better, too. Finer cast, in alloy 356-T6, with a wall thickness of .010 in. and

a tolerance of plus or minus .0015 in., these parts establish a new standard as aircraft fuel line fittings. Not only are they half the thickness previously considered minimum, but the tolerance itself has been halved. Although specifications call for inspection of these parts for fuel system service, they have thus far passed go/no-go tests without it. In fact, these plastic castings compare favorably with the wearability and strength of permanent-mold castings.

Savings up to 20% in time and money were realized by this company when it was discovered that the precision and consistency inherent in the fittings made it unnecessary to prepare expensive adjustable gage and fixture setups for finish machining operations. For the complete story on how this new development in casting technology can benefit you, call your Alcoa sales engineer. He'll be glad to work with you in developing sound, lightweight castings that can save you time and money. Aluminum Company of America, 1000-J Alcoa Building, Pittsburgh 15, Pa.



Your Guide to the Best
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THE ALCOA VIDEO—Television's finest live shows, Alcoa's quality emerges

determining stock levels at difficult locations in the tugboat system as well as recorder points and cycles. Through gate automatic stoppage, which stream could be handled on that basis and the impact of such a system on the flow of data.

• **Plastic jet composition.** Develop techniques for building up the most effective flows, kits for Strategic Air Command and Tactical Air Command. Kits must provide maximum logistical support, subject to limits on weight and size.

Heavy Research

Some of that research work will be done in AMIC, since it RAND and the bulk by research contractors. At the outset there were about 15 projects but the number will vary and the projects may be grouped in priority as various studies elicit.

Record Year Logged By Canadian Carriers

Ottawa—Canada's airlines had a record year in 1965 with total operating revenues of \$330,566,000 as against \$335,127,000 in 1964, according to a report by W. J. Matthews, chairman of the Canadian Air Transport Board. Net operating income amounted to \$8,153,000 compared with \$6,316,000 in 1964.

Number of revenue passengers increased by 25% to 1,100,000 while revenue freight was 147,481 tons, up 25% over the previous year.

There are now 1,500 commercial air-craft registered in Canada. The seven largest air transport companies in Canada are Trans-Canada Airlines, Canadian Pacific Airlines, Pacific Western Airlines, Maritime Central Airlines, Quebecair, Transair, Ltd. and Wheelair Airlines.

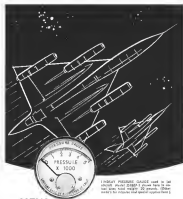
TCA's gross revenue increased 15% over 1964; passenger traffic was up 25% and cargo up 10%. CPA had revenue increases of 55% on international operations, 24% on domestic operations.

Pacific Western, operating with 85 aircraft, has done most of its work in the past two years on Orient East. Warning radar network construction. This job now is almost completed, and the Canadian Air Transport Board has been other large air freight jobs will come into being.

Norwest Canada increased its gross revenue by 42% on domestic scheduled runs and entered the long-haul charter trans-Alaska service.

It also did some DEW line air cargo work.

Quebecair, Transair and Wheelair were carried out most of their operations in northern Canada on charter passenger and freight operations.



NEW LINDSAY GAUGE

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The BMC-Lindsay Pressure Gauge for jet aircraft is made for extreme cycling and must meet endurance and overpressure requirements. Not only the most extreme conditions of shock, vibration or temperature disturb its accuracy. Pressure ranges from 1,000 to 15,000 psi.

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The bellows housing element is, of course, not a new development. However, the BMC-Lindsay techniques in rolling, heat treatment, calibration and external protection are new and exclusive to BMC.

Whether your back pressure gauge problems may be, why not let BMC engineering staff provide the answers. Write to either of the below addresses, outlining your particular requirements.

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LINDSAY PRESSURE GAUGES



DEW Line station, Pt. Barrow, Alaska, is one of more than 50 radar sites now in operation in 1,000-mile Arctic network.

DEW Line Adds 100 Minutes Warning

Nearly 15 months ago, *Avionics* Waxes' Aviation Editor made a 15,000-mile tour of the DeWitt Early Warning Line north of the Arctic circle in 25 below zero weather to give readers a first report on this vital extension of our aerial defenses and its construction progress (AVR April 16, 1956, p. 62). The now-completed DEW Line has been re-named to give *Avionics* Waxes readers a detailed report on its operation and the living conditions of the civilians who man this important outpost.

By Philip J. Kline

Point Barrow, Alaska—Excerpt: Early Warning Line, a network of more than 50 radar stations stretching across 5,000 mi. of desolate wasteland several hundred miles above the Arctic circle is now fully operational.

Apart from jets striking over the North Pole, the \$740 million DEW Line installation should buy 100 extra minutes of advance warning time

in which to muster continental defenses and launch strategic counterattacks. Existing DEW Line radars are not capable of detecting intercontinental ballistic missiles. But when variable radar and constant ICBM missiles become variable, those embedded bases in the far north, with their extensive communications and sensor facilities, will greatly facilitate detection of ICBM defenses.

Civilians Manned

Approximately 55% of the roughly 600 persons who man the DEW Line are civilians, employed by Federal Electric Corp. (Division of International Telephone & Telegraph Co.) which is under Air Force contract to operate and maintain the line. This represents a new approach to operating a specialized military installation—an approach which might find application elsewhere.

Military personnel are stationed only at a handful of major radar stations, to make technical evaluations and decisions and to provide Air Defense Command representation on the DEW Line. In

Canadian sectors, there are both USAF and RCAF officers.

With the DEW Line in operation, USAF has selected some additional details on the new radar network. Total number of stations is quoted at "more than 50," but exact number of each of these types of stations and their functions are left to speculation.

Two basic types of radar are employed on the DEW Line:

- **Rotating surveillance**, produced by Hughes, provides wide-area coverage which gives rough indication of target altitude in addition to precision target bearing and distance information. Radar is equipped with automatic alarm which alerts operators to newly detected targets.

- **Stationary gap-filler** called "Platter" and made by Motorola is used to fill low-altitude voids in surveillance radar coverage caused by earth curvature and/or high terrain between adjoining stations. Gap-filler radar also smaller antenna than rotating type, hence can be more conveniently mounted on towers ranging up to 400 ft. in height.



MAIN DEW LINE radars consist of large rotating surveillance radar. (In picture above, left) plus stationary gap-filler radars with automatic mounted 500-foot tower to fill in low-altitude voids in surveillance radar coverage. First parabolic antenna on shorter tower (right above) at left are used for tropospheric scatter communications links between stations.

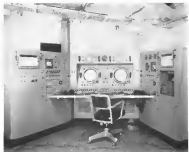
to achieve low-altitude coverage. Gap-filler radar is believed to be a continuous wave type and may employ multiple antenna beams to give rough indication of target position and speed. When target penetrates gap-filler beam, automatic alarm is sounded.

Three Station Types

The three types of DEW Line stations, their functions and the approximate number of personnel based at each are as follows:

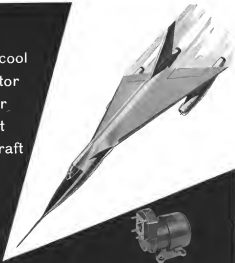
- **Main stations** are equipped with rotating radar, plus at least two gap-filler radars. This type station serves as communications, data collection, computer and supply center for 6-11 smaller stations within its sector. Main site is manned by approximately 55 persons, some of whom are using maintenance specialists, visiting other sector sites as required. There are believed to be three to five main stations along the 1,000-mile line. One is located at Point Barrow.

- **Auxiliary stations** are equipped with same rotating and gap-filler radars as main stations, but its physical plant is



RADAR console at main station has two scopes to show targets at different altitudes.

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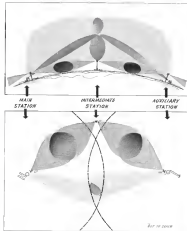
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TYPICAL LAYOUT of adjoining DEW Line stations shows how intermediate stations provide low-altitude pick-off coverage between major mainline sites. Apparent low-altitude gap over intermediate station is exaggerated because drawing is not to scale.

only about half as big. Auxiliary station is manned by about 17 people, all civilians. There are believed to be about 20 auxiliary stations along the line.

Intermediate station is smaller of the three types, equipped with gyroflex radio only and operated by only two civilians. At some angles, intermediate station usually is located between two of the larger stations to fill in low altitude voids. However, in some locations two intermediate stations are used to fill the gap between two larger stations because terrain or supply problems make it necessary to locate the latter in sites where ideal radio coverage could not be obtained.

Penetration Tests

Series of three penetration tests have been run against the DEW Line to check its effectiveness, according to Brig. Gen. Stanley T. Wynn, chief of Electronic Defense Systems division, Air Materiel Command. These tests

wedged that the line is "100% effective from the deck up to extraneous high altitudes against below-sonic aircraft."

Gen. Wynn says: "Without disclosing specific detection ranges, Gen. Wynn says the DEW Line radar 'scans out surfaces and targets that are not in its line of sight'."

To foil enemy countermeasures efforts, radars are designed to permit rapid change of operating frequency.

Globalwide, further communications networks interlink all stations along the DEW Line and connect key sites (mainly main stations) outward to Air Defense Command headquarters. UHF-to-high frequency (UHF) transponder tracks provide voice and teletype communications between stations. VHF intercepting system provides relay and limited voice communications back to ADC. Scatter engagement was made by Collins Radio Co.

For remote lateral communication, an automatic dial telephone system pro-

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Use new Gulfgrade Aviation Oil Series D, the detergent oil, or Gulf Aircraft Engine Oil, the straight mineral oil. Either way, you'll be keeping your engine clean, and playing it safe.

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Gulfgrade Aviation Oil—Series D Detergent Oil—for greatest possible cleanliness in metal, mixed horizontally opposed engines.

Gulf Aircraft Engine Oil—Straight Mineral Oil that maintains sludge and oil inlet valve deposits, keeping your engine clean and safe.



...the world's finest aviation products



DEW Low stations provide small but comfortable quarters, including private bedrooms (left) for each man. Modules of recreation area (right) depend upon size of station. Recreation facilities include photo dark room, sound movie projector, 16 photograph system.

ness speedily communication between any two stations anywhere along the line. Calls can either dial the receiver of party he wishes to reach, or dial connection into the station's public address system to page his party.

Tactical information on radio targets (position, heading, altitude, etc.) is transmitted from outgoing radar sites to area stations by type of data link which presently permits automatic display of tactical situation in the see it.

Two large radar scopes at main station console are monitored by ceiling "radars" (radio operator-teleoperator). One scope displays aircraft at high altitudes, the other at low altitudes. When new target is sighted, data on the radar is sent into data link transmitter by means of series of console knobs, then instantly transmitted at peak of a button.

Large weather link between stations only use two telegraphic stations, approximately 15 ft in diameter. Dred stations permit space diversity operation for improved performance and provide back-up in event one antenna is damaged.

Arctic Economics

Cost of building the DEW Line is credited by one-third the original \$400 million estimate. The savings resulted from lack of previous Arctic construction and logistics experience upon which to predict costs accurately. In the Arctic where fuel oil for example, costs \$100 per barrel, at a good connection usually to make a higher initial investment in order to save on subsequent operating requirements.

In certain locations where extremely long telegraphic scatter range was needed, Western Electric decided to build extremely large (30 and 60 ft.)

hyperbolic sector antennas rather than resort to higher power transmitters. Although initial cost of building the large antennas exceeded the cost of buying higher power transmitters, the subsequent saving in electric power consumption, and lower in fuel oil consumption, more than paid off the large antennas.

Another interesting example of Arctic economy is the use of waste heat from the station development and acoustic equipment to heat the complete station, despite 35 below temperatures. Each station has a small oil burner for emergency and/or supplemental heating but in most stations this was not used last winter.

Men Who Make the Line

Federal Electric's DEW Line employees must sign up for an 18 month tour, get only a two-week vacation midway through the tour, get 70% of the tour are married.

Major attraction undoubtedly is the

good pay. Salaries reportedly range from about \$8,000 to nearly \$20,000 for top supervisors. However, there are other attractions. One married supervisor frankly admits that he signed up because of "personal problems at home." Opportunity to live in one of the remaining outposts of civilization, which offers good hunting and fishing, appeals to many.

Chance to Advance

Some young technicians, without any previous degree, find the DEW Line an opportunity to learn into supervisory ranks. Average age of supervisors is only 32, average of technicians is 26, average for mechanics is 34. Golden rule of the line is 40.

Normal work week consists of an on-call day, with one day off. However, there is little margin for error, particularly at smaller stations, so even the most advanced to emergency duty and there is no overtime pay.

Men are rotated among the different stations in this sector. This is particularly important for the two men stationed at the smallest intermediate site. Normal hour-day there is about five or six weeks. Each man has his own private bedroom, small but comfortably furnished, to give privacy when desired.

Federal Electric carefully screens all personnel before hiring, then trains them for about six weeks in Silver, Ill., before sending them north. Considerable cost goes into the selection of their best and most, particularly in the north, a reputation to make. One DEW line chief reportedly worked at a top New York hotel, but wanted "to get away from it all" for a year. A large level of civilian, fresh but is almost available for much.

Each station has recreation facilities.

Company Confusion

Unfathomable confusion has resulted from the fact that American Telephone & Telegraph Company's Western Electric division built the DEW Line and International Telephone & Telegraph Company's Federal Electric Corp., a field service subsidiary, will operate the DEW line under USAF contract. There is an corporate relationship between AT & T and I.T. & T. The former is best known as The Bell Telephone System, while I.T. & T. is perhaps best known as the nation's railway as the result of its Federal Telecommunications Laboratories which developed Tams and Norcote reception systems.



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"MAIN" radio station at each major air
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and off-base structure.

Although large stations naturally are better equipped. These include high fidelity sound system and record & turn, reading library, photo darkness and supplies, sporting goods. Stations are equipped with 100 watt sound music projection and points of the latest films are flown to and shown along the line.

Each main and auxiliary station also is equipped with a Collins "hard" train station and receiver which serves both in emergency radio facility and a special of education and occasional contact with home. Rig is operated by licensed radio operators, of which there are many among the military and navy units. Sound line operation are or instantly conducted, but conversation is quickly interrupted when their identity is established in Boston.

A FX at each main and auxiliary station supplies personnel needs like cigarettes and snack blades. These are purchased with coupons from books sold by Federal.

Marcie Good

Some of Federal's own have been on the line for more a year, giving an advance of DFW Live coverage to see the transition from Western Electric's personnel. Marcie appears to be excellent and men to whom Associates. Marcie talked showed no obvious signs of homesickness or discontent. However, by Arctic standards Puerto Rico is a paradise. Several miles from the radio station is a settlement of several hundred Americanized Eskimos and a few missionaries.

Personal attrition rate from all crews is running about two per cent

3000 PSI SOLENOID PILOT OPERATED 4 WAY 3 POSITION SELECTOR— with 125 psi Minimum Actuating Pressure!

This solenoid valve provides electro-hydraulic control of test cells closed drive or speed links (fraps and permits fraps to be extended and locked in any desired position.

Spring return to neutral is augmented by actuating pressure, ensuring positive action even in presence of contaminants or oiling.

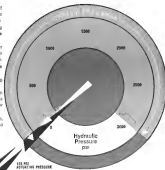
Operating at extremely low pressures, this Whittaker Solenoid Pilot Actuated 3000 psi non-interference Solenoid Selector Valve actuates at a pilot pressure of only 125 psi.

It is a high-flow valve—18 gallons per minute for a 1/2-inch tube size valve.

Integral filters and provisions for manifold or shutoff are provided. (Stacking height is two inches.)

Unlike conventional 4W 3P units of this type, the normal position is a flow position and the blocked position is obtained by energizing Solenoid A and the other flow position by energizing Solenoid B.

This unit, P/N 150475, is in production. Similar valves, designed to meet your requirements, will be designed at your request.



PERFORMANCE

TEMPERATURE: -40°F to +150°F dry
and ambient temperature

PRESSURE: Operating pressure 3000 psi
at -40°F to +150°F

PRESSURE DROP: Locked pressure
drop at 18 gpm at 150 psi

SERVICE FLUID: MIL-H-8080 Hydraulic
Fluid

ACTUATING TIME: Pilot valves of this
type are normally fast in operation. In
this case the speed of operation has
been determined to eliminate adverse
effects on system.



Whittaker

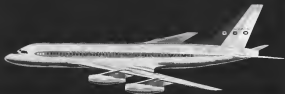
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► **Top and Tuck-Header Aircraft and General Electric** are causing neck and neck for deliveries of long nation's largest producer of military electronics equipment. Although Hughes does not release figures on its annual sales, and GE does not leak out its defense electronics from total company sales, each is expected to approach \$460 million this year in military electronics business.

► **SuperSpeed Memory** — Ceregrus Systems Inc., with corporate base of one hundred employees of a second 10,000 microsecond has been developed by Teleconcord Systems Machines Corp. New cell, consisting of sensitive printed circuit of metallic lead, must be operated at near absolute zero (-459° F). Devices require only about one third the driving current needed by present-day ferrite memory elements, IBM says.

► **Unusual Twist** — In a period when more companies are eagerly seeking to expand their field of activity, Schenck Electronic Systems division has announced that it will concentrate its efforts in which it has proven experience and established competence and will not attempt to obtain business outside these areas. This statement of policy is part of new report on division's capabilities.

► **First Air Defense-INTACC** is name of new experimental automatic tracking and control console developed by General Aeronautical Laboratories and currently evaluated by Navy for first air defense. Equipment is designed to simplify task of shipboard air controllers in detecting intrusions to target.

► **Signal on Dotted Line** — Recent results awarded announced by number of various manufacturers include:

► **Caltech Radio Co.** will provide communication and navigation equipment for the American World Airways air jet fleet 32 Boeing 707s and 25 Douglas DC-8s, under contract extending full million dollars.

► **Radio Corporation of America** is award \$1.5 million Navy contract for development study of an ultra high-speed digital computer and data processing system.

► **Sperry Gyroscope Co.** received \$4 million Air Force contract for production of its AN/APN 59 airborne search and navigation radar.

► **Adams Corp.** received \$4.5 million Navy contract for development radio navigation system, a \$1.5 million Army contract for receiver transmission.

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for helicopter, and a Navy BuBuys contract for over 50 million for a radar system.

• **Ballco/Procon** announces a \$1.1 million order for 20 transponder light control stations for use on General's 850 pilferers. Ballco says if flight control will be used on new fleet addition of 17 or less.

• **General Instrument Corp's** Micro-mold Electronics division has received Army contract to develop methods for producing capacitors with recombinated outflow rates in order to ease U.S. dependence upon foreign sources.

• **Siemens-Pace's** "World's greatest chip" is claimed by Westinghouse Electronic Corp. with suggestions less than one part in six billion. Westinghouse says it will license other companies to use silicon surface process developed out of techniques developed by Siemens & Heller and Siemens-Schuckert Companies in Germany.

• **Two Many Trade Shows?** Survey by Electronic Industries Association (last week RETMA) indicates majority of its members prefer only two trade shows per year, less than 11% favor more than four. Average cost of exhibiting at trade shows is \$15,000, an increase of 34% over previous year.

• **Crowing Crystal Filter Market?** Attractive advantages of crystal filter may double the market for quartz crystals per month and make for frequency of error purposes. Prediction was made by Irving Axell of the Army Signal Supply Agency at Western Electronic Convention. Axell indicated that use of crystal filter would grow slowly, but to reach a large percentage of the 750,000 commercial two-way radio communication sets purchased each year will require quartz crystal filter. Ultimate potential market may exceed 400,000 filters per year, Axell said.

• **Nuclear Communication?** Army's Signal Engineering Laboratories are in research in possible applications of gamma radiation and neutron traps to communications and surveillance (see page 18). Dr. Harrison J. Merrill reported during recent Western Electronic Convention.

• **High Definition CRT—Cathode ray tube whose face is coated with green transparent phosphor, reportedly capable of giving resolution of 0.0005 in., was displayed by General Electric at Western Electronic Convention. See also color tube, suitable for color displays, can be made by applying two or more transparent layers of different phosphors. Change of color display is accomplished by changing anode voltage using out-of-phase electron gun.**

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Now the Company offers a complete line of timing meters and clocks in round the operating time of any electrical or electronic equipment. Compact, accurate, simple, each unit has two dials. They can be used to provide duty running time plus a total running count, eliminating misreading or internal relaying. They measure distance and volume counts, since they provide the standard way to know when to intervene, overhaul or replace equipment. They give an instant picture of idle and working periods for machinery. And with electronic equipment, they act when to replace tubes, remaining steady failures during extended operating periods.

In both AC and DC, continuous or manual reset for 60 or 90 up to 400 cycle line frequency. All features based on one design in 1/2 inch of space. All models can be supplied with float battery for use in most MIL-14428.

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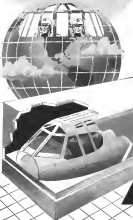


Shows at the left is the new A. W. Haydon Co. catalog describing the complete line of timing meters and clocks. If you haven't received your copy with the A. W. Haydon Company letterhead.

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Similarly, integrating the complex jet transports into today's complex traffic patterns calls for experience that can no longer be gained in the air alone. Crews must be acquainted with new flight and communications procedures, holding techniques . . . with new navigation aids and airborne equipment. This calls for precision flight simulation — on the ground. Already, such major airline operators as Pan American World Airways have pioneered DC-4 and Boeing 707 instrumentation programs built around Jet Simulators designed by Curtiss-Wright. The airlines and the military alike have selected Curtiss-Wright as the basis of its proven experience with every type of simulator.

Simulators by Curtiss-Wright realistically reproduce every aspect of aircraft operation, with the highest precision and fidelity in the industry. They add to the safety of flight, save millions of dollars and thousands of man-hours yearly for both commercial and military operators.

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Programmed Auto-Assembler

Programmed component assembly system, operating from punched card instructions, automatically inserts up to 30 different small lead components in printed circuit boards at rate of 15 seconds per component. Machine was developed by International Business Machines Corp. for own use, but improved version with component placement rate of one per second may be marketed for about \$100,000. Components are mounted on mating tape belts wound on tape reels, similar to tape reels used by United States Machinery Corp.'s automatic component placement machine. IBM machine differs in its use of punched card programming. Printed circuit boards up to 30 in. square can be manufactured.

NEW AVIONIC PRODUCTS

Components & Devices

• **Schematicator** relay, Type 47, provides continuous duty in 200 C and intermittent duty to 250 C. Used single



0.5 oz. and measures approximately 0.75 by 4.12 by 0.47 in. Manufacturer: Bell-Tech Corp., Newton 38, Mass.

• **Magnetically held automatic disconnect switch** detects when outgoing voltage drops between 75 and 5 volts. According to the manufacturer, switch will withstand vibration, temperature to 500 cps at 1000 loads, weighs less than 2.5 lbs. in and weighs 4 oz. Switches are available in single pole and double pole models from Lev. Inc., 110 Jones Ave., N.W., Grand Rapids, Mich.

• **High Reliability capacitor**, Type B 125, is said to be the most suitable to meet all requirements of proposed

specification MFC-14157A. Capacity drift with temperature from -55C to 150C is less than 0.5%. Resonance resistance exceeds 10,000 megohms/volt at 15C. Units are available in 300, 400 and 600 volt ratings and in all thicknesses. Manufacturer: Electron Products Co., 450 N. Eldorado Ave., Pasadena, Cal.

• **Tube base** mounted along replacement for the first full wave rectifier, 500V ac 50 plug directly into the conventional sockets. Unit features an output of 55 v. d.c. maximum, rated voltage of 400 volts max., and maximum peak.



current of 215 ma. Minimum PIV is 3,250 volts and leakage drop is 6 volts at 70 ma. Produced by International Rectifier Corp., El Segundo, Cal.

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MODEL 1154

Designed to meet the existing lighting and performance requirements of jet age commercial, military and business aircraft, Pioneer-Central's new Vertical Velocity Indicator features integral lighting and rapid response indicators.

Rapid response enables the pilot to quickly establish and maintain uniformly precise rates of ascent and descent during climb-out and let-down—a necessity in today's high-density traffic routes and at the high speeds of modern transport aircraft.

Another new feature—integral lighting—reads white by day and red by night. Red—the color nearest the proof-of-best suited for "dark-adapted" eyes—provides sharper readability.

Model 1154 complies fully with lighting specifications MIL-L-25467A and a CAA approved TSO-C13a. Units are available in either standard 2" bezel or clamp-on style mounting.

Turn-and-Slip Indicator, Model 1122, is another new member of Pioneer-Central's family of fine instruments. It, too, provides integral lighting for better readability, reading white by day and red by night. Like its companion, at left, it complies fully

TURN-AND-SLIP INDICATOR
MODEL 1122

with lighting specifications MIL-L-25467A and is CAA approved to TSO-C13a.

Equally important are two additional design features—provision of a power failure indicator and reduced weight. Should power fail at any time, the flag shown at "off" position, upper right, instantly informs the pilot the instrument is inoperative. Reduced weight and simplified installation are achieved by the use of a gyro motor design operating from a single-phase 400-cycle AC power source. A smaller unit is available with enclosed gimbal for installation in tilted panels.

Turn-and-Slip Indicators of various types are available to operate from single- or three-phase AC, DC, or air power sources. Companion instruments are in process of design and production—Airspeed Indicators—Fuel Flowmeter Systems—Breathing Oxygen Equipment.

For complete specifications write Pioneer-Central Division, Bendix Aviation Corporation, Department Two, West Coast Office—117 E. Providence, Burbank, Calif. Export Sales & Service—Bendix International Division, 205 East 42nd St., New York 17, N. Y.

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BUSINESS FLYING



SUPERCHARGER T-62 (right) is priced despite standard T-62, which has supercharged engine.

Aviation Week Check Ride:

Performance Rises in Supercharged Gull

By Richard Swearey

Los Angeles—Trendler Amphibians, with high gull wings, supercharged piston engines and the high drag normal to boat hull configuration, yields excellent performance for its class and has good flight characteristics.

Enclosed a Pappo design which has been in use with Indian Navy for some years, the plane was redesigned for U.S. certification under CAR 1 Standard and Category. Official description is

P17612, using Lycoming C50-450 A1A6 engines rated at 540 hp each for standard and three bladed, constant speed, full feathering Hartzell propellers.

Earlier model, now known as the Standard, was P11611 and Lycoming 270-hp C50-450-B1 engines (AW Aug. 29, 1955, p. 18).

Plane is fabricated in Pappo's Green plant. Wings built section and empennage units with all cables, plumbing and wiring controlled are shipped to

Trendler's Milwaukee assembly facility. Standard U.S. hardware and fittings are used throughout.

Use of supercharged powerplants has given the plane an increased gross take off weight from 6,800 lb to 6,614 lb its best operating. Water takeoff gross weight the supercharged aircraft is 6,900 lb, while earlier LJ had same TO gross as the last, 6,900 lb. Higher power also has boosted performance throughout the cruise flight envelope to put the amphibian into a class competi-



ENGINES are accessible to men on ground without ladder (left). Flight instruments are on left of panel, engine controls on right.



SUPERCHARGED Golf model flies over New York delta. Licensing C80-48-3345 expires until 140 hp; replace 140 hp. Licensing C80-48-3341 expires on standard Golf. This engine and standard Golf shown on these pages are demonstrations belonging to New York distributor Robert Cook Associates.

live with head-on light from aircraft.

Pilot's cockpit from regular light from, small windows or larger transport plane will find improvement of pilot's technique required but not difficult. The plane has good stability, and control characteristics, with perhaps somewhat shorter reaction time to changes in power and attitude than have been experienced in other aircraft.

Pre-flight Check

The flight without shock is started and with the addition of unexpected ball drop plays for lightness. Ball has an aileron compensator with a plug in each, located just left of centerline on each. One plug is located on right side of each wing tip float, and tip floats are interchangeable.

Inspection of compressed air and hydraulic supply is accomplished in left wheel well. Normal emergency inspection includes checking tail wheel shock, vent line to assure proper structure.

Italian design wheels and brakes, which are interchangeable left and right, are tested that water and spray produce no damage. In addition, plane can be tested directly from water into runway by lowering wheels at very slow speed before tracking ramp and taking right on out of water.

Wheel-based landing gear operating handle is on lower left front of pedestal and incorporates mechanical lock which is self-engaging when handle is moved to wheel down position. Adjacent to the tail wheel lock lever. Aileron from wheel is just above wheel and tail wheel operating lever.

Flap operating handle is on right of pedestal, just below propeller controls. Flap hydraulic system is such that handle and flap movement are instantaneous, and relative flap moving at same time and at same rate as handle movement. Flaps remain at whatever setting is left on operating handle.

Emergency Pump

In case of hydraulic pump failure, emergency hand pump is located between pilot's seats. Operating lever is placed in desired position, hand pump is actuated to pump gear or flap. In case of main hydraulic system failure an emergency system is provided which will operate in low or main landing gear, and a check valve returns fluid to tank lines for use.

On the ceiling are ladder trim, water rudder extension and retraction handle plus combination circuit breaker-gear, along switches for all lights and switches on fuel gauges.

Fuel system consists of two 55-gal fuelage tanks in center of gravity range. A cross feed is incorporated although normal procedure calls for left engine feeding from left tank, right oil right. Mechanical fuel shut off valve operating handles are located on left column and just under instrument panel and ahead of door.

Just behind windshield with the plane, a standard light-weight shock will assure safety. Engine starting procedure and sequence are standard for supercharged. Since engines lack forward, right engine gear starting capable on the Golf. Fuel boost pumps are on a system left in side of fuel tank. Fuel boost pump is required by inspection.

Test Velocity

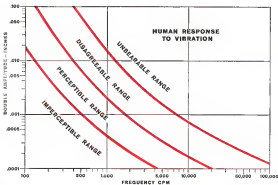
Although Tardier Amphibian is a three-point airplane, slope of ball nose velocity visibility during low compatible with any three-point aircraft, and forward slope is gentle enough to further increase visibility.

This technique calls for locked tail wheel mode in a practical. With its boat hull and large vented tail surface, plane will only experience a tail wheel is included. In addition, with propeller at center of gravity and new geometric center of plane, a difference can be noticed in set of power during test.

Although handles are simple for emergency use, but procedure is combination of undesired demands as

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EASTERN DISTRIBUTOR Robert H. Cook drives a new nylon spreader into a field yesterday, Carlton Mitchell, for his grain seeding using Yale's Versatrac.

quickly as possible when testing with fertilizer included.

Engine output is standard for C80 400 horsepower (rated) at 2,700 rpm plus one through at about 1,700 rpm.

Engine Cooling

A feature of the Tractor's emphasis is its engine cooling. Adequacy of cooling is such that even during extended ground runs no hot dies, overheating does not tend to occur. In fact, cylinder head temperatures generally remain below 230C, rarely exceed this figure.

Aircraft used in the evaluation was N218A, Tractor 1.2 prototype-turbine demonstrator. Engines were original ones, advance and powerplants each had 475 hours by then. Empty weight of plane was 6,660 lb., and with stand and 70 lb. of equipment, was at specified empty weight for Tractor's emphasis of 4,670 lb. Fuel weight was 1,140 lb., plus 56 lb. of oil. With these figures shown and baggage, aircraft grossed 6,551 lb. at takeoff from Van Nuys Airport. Company representatives showed were Wallace Watson and Alan Cooklin. With aircraft on temperature of 90F, altimeter setting at 30.00 in Hg., and 790 ft. MSL, elevation, plane broke ground after slightly more than 1,000 ft. run.

Throttle Step

In Tractor's emphasis, takeoff power can be applied at lower elevations with out waiting any mechanical steps are unimportant for throttle which hold manifold pressure to maximum 40 in. for C80-400. Manual shift takeoff setting is 18 deg.

The Tractor's recently rolled Road Cell, is a fairly short coupled airplane very similar to any. Rudder is, even though effective and persons on light throughout manual flight envelope. There is no apparent feel of drag the

hell as appears on large drag boats.

Take takeoff technique calls for getting into level flight attitude as quickly as possible, with rudder applied very gradually, for yaw correction. Yaw in almost unnoticeable due to engine location and its effectiveness. In level flight attitude, nose slope above gives more down impression.

Plane accelerates steadily to takeoff speed of 85 to 90 mph. Maximum single engine control speed (V_{max}) is 91 mph, which is given shortly after lift off. Climb is good, just attracts at average speed. Fly attitude is neutral.

Climb Settings

Power setting for climb was not quite MITO (45 in. MP, 3,300 rpm). Rather, power was C80-410 setting at 48 in. MP, 3,000 rpm was used. At 48 in. MP (indicated air speed) of 120 mph, climb rate was 1,600 fpm.

Climb rate at 15,000 ft. using full throttle 12 in. MP and 3,000 rpm was 500 fpm, at 115 in. MP at 18,500 ft., 100 fpm, plane still registered 200 fpm. rate of climb.

Plane turns out well for cruise condition. Takeoff stability is high, resulting in tendency to follow established flight path. Adjustable seat adds pilot comfort for extended cruise and more level is taken at lower power settings. Decreases from that of takeoff and climb.

Airspeed readings at altitude at various gear, angles and power settings attached the following: at 20,000 ft. 65% rated rated power (NRP), true air speed (TAS) was 181 mph; at 20,000 ft. 53% NRP, 164 mph; TAS 20,000 ft., full power, 186 mph; TAS, at 16,500 ft., MITO power 195 mph; TAS. Gross weights run from 6,510 lb. to 6,390 lb.

High altitude stability and control characteristics, indicated at 20,000 ft. at gross weight approximately 6,390 lb.,



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Door Seals for the 707

Passenger door seal (left) and galley door seal (right) are produced by CHR for the Boeing 707. Material's high tear strength allows rubber reinforced with Lycra for abuse. Resists heat, abrasion, ozone and weather resistant seals, non-stretching, flexible in extreme temperatures.

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The real governing factor in overhaul cost are the amount of Research and Modernization done and the number and quality of parts used. Research depends on the judgment factor built into the needs of the user in the design. The extent of modernization also depends on the standards set by the overhaul agency. The more quality and reliability conscious the agency—the greater research and modernization will be considered necessary. But one solid good procedure is better, better engine.



Prices for parts range all over the lot. The highest prices are for the best. Factory New Parts direct from the manufacturer. The lowest prices are for the cheapest, unproven, "cheap" parts. Almost none are quality parts—meeting modern specifications. Then you risk part as expensive as receipt to make sure it is not "cheap".

It boils down to this: . . . Airwork overhauls may cost a little more because more safety and reliability has been built into the engine. You get quality you pay for — and save money in the reduced operating cost during the life of the engine.

selected excellent characteristics. Stall characteristics at altitude include stall warning horn sounding at 85 mph IAS. A stable recovery if loss, pressure is reduced at first seven knots, and loss of approximately 180 ft. in the highest point in flight path. Power setting was 13% NRP, approximating a normal cruise condition, with a straightaway flight path, clean configuration.

Aircraft holds well in steep turns at altitude, with high turn rates attainable without high speed stalls. With the aircraft's simple and effective caddis, degree of displacement maximum. Falls within rather restrained limits, more several changes producing slip in field.

Medium Altitude

Medium altitude investigations showed stall speed decreased to 75 mph IAS for approximately same flight conditions, 55% NRP, straightaway flight path, clean configuration, gross weight approximating 6,000 lb. at altitude of 12,000 ft. Airspeed sample showed 85 mph IAS at 45% NRP (34 in MP, 2,400 rpm), MFTVO power (87% NRP) yielded 190 mph TAS.

Low altitude investigations covered banking configuration at normal, low and maximum airspeeds, considered single engine go around, with all various power settings, various configurations, use and two engines operating.

In banking configuration one only down, stall speed at 123 knots 2,400 ft., aircraft returned good stability and control characteristics throughout production turns and steep turns up to 30

deg. bank, angle. Characteristics at normal point of 100 mph IAS to level flight, climb and descent, straight and turning flight path, stall at 150 IAS maximum permissible speed with gear down, in same combination of flight path.

Single engine go around used 5,000 ft. in controlled ground level take investigation was conducted over ocean flight test area off Los Angeles coastline. Gross weight approximated 6,000 lb. Procedure was furthering of right turn engine approximately 300 ft. above controlled ground level with airplane in full climb configuration at final approach speed of 210 IAS. Sequence used was full power to operate engine, establish climb, sample control characteristics in trimmed and untrimmed conditions, sample deviations of its operating engine, clear up and return aircraft, restore road engine.

Plane held altitude and established slow rate of climb when full power was applied to operating engine; speed was returned to 205 IAS. Control losses were heavy in untrimmed condition and high deviations were necessary to hold airplane to desired altitude and flight path. While airplane was held untrimmed, fast cleanup and complete of emergency procedures were point effort considerable, in addition to adding performance. In single engine go around, the airplane has a performance margin at high gross weight.

As starting procedure follows normal sequence requires both hands at one point, making a good bracket desirable

to reduce deviations in flight path during start.

In a sustained rate climb, both on gross at METO power, the aircraft held a 1,200 fpm rate of climb from 5,000 ft. to 7,000 ft. Maximum gross power (75% NRP) at 6,000 ft. gave the plane 174 mph TAS.

With right engine inoperative at 7,000 ft., gross weight approximating 5,000 lb., ambient air temperature 90°, plane registered 130 mph TAS with maximum climb (75% NRP) on operating engine, conditions resulting sustained climb on one engine.

Low Altitude Stalls

Stalls at low altitude, 6,000 ft. showed a decrease in stall speed from 95 mph IAS down to 90, 85 and 80 mph IAS, in airplane configuration produced from clear through gear down, gear and approach flap, gear and full flap, at cruise power.

When the aircraft is held through the buffet region into a full break, a sharp nose down pitch and right hand roll occurs, requiring high control deflections for recovery, and resulting in loss of altitude. Some condition hold true when airplane is forced into the complete stall with one engine inoperative, with a proportionate increase in pitchdown and roll in upgrade.

In maximum performance takeoff and landings, aircraft made another pull-back investigation. Sample was taken on hard surface runway, gross weight approximating 5,500 lb. on level air temperature 91°F. In landings,



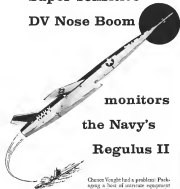
Mosquitoes to Cover Arctic Islands

Modified Mosquito 35 will be for use by the Service Air Services Ltd. to serve 220,000 sq. mi. of Arctic islands in within 500 mi. of its North Pole. Company is one of three firms awarded the photographic work by Canadian government. Squadron consists of 52,000, 156. Other two firms are Photographic Service Corp., Toronto; a British Shading Camp subsidiary, and Air Service Ltd. of Vancouver. Service's five Mosquitoes will cover triangular area from 33,000 ft. to provide base for new maps and will include using of DEW Line, the southern boundary of the triangle. Service may build two new landing ships at the coast.

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Super-sensitive DV Nose Boom



monitors the Navy's Regulus II

Chosen Vought had a problem: Packing a host of sensitive equipment in a nose boom to monitor the

Navy's new guided missile, Regulus II. This "packaging" was additionally complicated by the requirement that to conserve storage space on board a submarine, the boom must fold automatically by remote control.

Dalmo Victor's engineering skill, acquired through development of airborne radar antenna design, provided the answer.

The two-foot DV pivot static boom, as required by the Navy, meets these most exacting design requirements and provides vital data, including azimuth and altitude, as well as angles of attack and yaw.

Long recognized leader in airborne radar antennas, Dalmo Victor now applies its experience and skills to create missile components. Contact the nearest DV office for help in solving similar problems.

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Gull Performance

Cruising speed, 1900 power, 11,800
Rt., 190 mph
Rate of climb, 0.75 engine, sea level
3,279 ft/min
Rate of climb, one engine, 275 ft/min
Service ceiling, 21,300 ft
Stalling speed, landing configuration, 72 mph
Maximum one engine climb, 93 mph
Range, 500 power, at 14,000 ft, 980 mi
Takeoff distance, land over 50 ft
Altitude, 8,640 ft
Takeoff, water, no wind, 14 sec
Landing, over 50 ft obstacle, full flap
1,800 ft

advantage can be taken of the Gull's unusual high ball drag to establish power balance on final approach, effect a swift flareout and power reduction, putting the aircraft onto the ground quickly.

Water performance: sea approach was performed at Lake Mead, Nev., altitude 1,220 MSL, ambient air temperature on water surface was 101°F. Gross weight approximated 5,430 lb. maximum for water operations.

Landing technique calls for leveling off just above water surface, cut power and allow the aircraft to stall onto the surface at some high altitude.

Takeoff technique calls for almost displacement until speed is gained, pulling the aircraft into the slip, becoming airborne at approximately 60 mph. The setting is 15 deg, since in the land takeoff.

Airborne takeoff was registered as 17 sec. then power application until aircraft was definitely airborne. Maximum takeoff was time was 21 sec.

Water test observations were: efficient, water cooler was effective at proper speeds with good stability from yaw turn to turn. Using differential power for directional control in water was requires care.

Plane's overall performance on water was excellent. Windows stored line of view at all times, although water surface was relatively calm.

Although Tracker amphibian's design is shorter than land based planes of same gross weight class at higher speeds, compare indicators studies have shown it cannot approach amphibians in shorter flights than with landings.

For equipment, Tracker has been installing two Domo cross axis, 22-channel transmitters, with location modules. Composite plane also incorporates photo slope sensor, registering through use of the Domo such a device which is available to customers. Weight of equipment was 50 lb.

Present production plans call for the 5.2 supercharged version, but custom on now order the standard 5.2 aircraft.

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Big Bob Schmidt and Shell, working together at Tucson, Arizona, Airport have increased aviation fuel sales fivefold since 1948!

Seems everything's big at the Tucson Airport—Big Bob, big sales . . . and big plans that are underway to extend the 12,000-foot runway to 15,000 feet, making it the longest in the world!

"One of the things that attracted us to Shell," says Bob, "was the company's reputation for helping dealers grow. We know there must be good reasons for it. We soon found out. Giving engineering and other specialized assistance to help dealers build for the future is one secret of Shell's position as an aviation supplier.

"For example, when we needed more bulk space, Shell engineers designed and supervised the construction of storage facilities.

What's more, Shell's technical representative is always here when we need him, making our job of keeping our customers satisfied a lot easier."

And at Tucson, customers are satisfied. Pilots know that a Tucson stopover means a lot more than sunny weather. Big Bob gets them in and out again—fast! He delivers the kind of service they need for on-schedule take-offs every time.

Responsibilities fall on Bob Schmidt when he's away from the airport too. Bob is president of the National Foundation for Asthmatic Children, president of the American Association of Airport Executives, a director of the Tucson Metropolitan YMCA, and chairman of the Y's Southside Branch.

Shell is constantly on the watch for men who can build careers to match that of Bob Schmidt.



Composite plane tower post control tower is now in operation parking space. New operations building and taxiway front are under construction.



Big Bob and Shell representative "Nobby" Niebauer stand near bulk storage tanks discussing plans for still further expansion of airport facilities.



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Cessna 310B in flight. Improvements in accelerated largely in improved handling characteristics and stalling changes.

Cessna Improves Handling in Model 310B

Los Angeles—Major changes in flight envelope and characteristics in Cessna's 310B model involve expanded operating limits rather than basic flight and handling characteristics. Other changes (AOW July 5, p. 124), are mostly for comfort and styling.

One of the most important changes is in maximum single engine speeds, and while standard 310 evaluated by American Women last year (AWW July 16, p. 50) had a maximum single engine control speed (Menz) of 93 mph indicated air speed (IAS). New model's Vmc is placed at 64 KAS, a reduction of 11 mph. However, 310B has a placarded maximum take single engine climb speed of 93 mph IAS.

Extra Margin

By pilot checklist, difference is that formerly, if airport was below 93 IAS, landing could have been considered committal. Now, if airport still exceeds 60 IAS, safe go-around can be considered and initiated if pilot chooses.

However, check pilots are cautioned to make sure that pilot being checked not relies that acceleration to the 93 mph figure is a requirement, and that airplane should be cleared as quickly while in a steep level attitude, in which case the acceleration will be quick to the desired airport. No changes have been recommended in standard two-engine landing technique or placarded speeds.

Since the plane now has 180 lb. heavier maximum takeoff gross weight, of which 55 lb. has been picked up as useful load, there have been some changes in recommended climb speeds, plus increases in stalling speeds at various angles of bank at various gross weights. Biggest change here is in best angle of climb speed, now recommended at 50 mph IAS for sea level

and 95 mph IAS at 15,000 ft., where formerly, speeds of 105 IAS at sea level and 123 IAS at 15,000 ft. were placarded. Placarded stall speeds are up from 2 to 6 mph in the various climb attitudes.

Fuel management has been changed if the optional auxiliary tanks are installed. The tanks incorporate no boost pumps, so start, bleed and climb (best



OUTWAVE rollers were with changes. They include top tank configuration, more two-part ailerons, flush mounted tail, electrically operated pilot flap, redesigned interior.



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INSTRUMENT panel is new. All navigation and communication equipment is located in center and accessory systems have been relocated. New lighting, cues and post lights.

30 m/s. optional) on main tanks is recommended. In addition, new carburetor mixture lean and vent into main tanks, space is allowed for vapor and fuel return to main tank while the 15 gals. available in each of the auxiliary tanks is being consumed.

Other differences include a placarded speed of 160 mph (AS best) versus the 140 mph of the 15 day. In addition, maximum speed with gear down and full 45 day. Day is now 140 mph, up 10 mph from earlier model.

Number of changes resulted from USAF evaluation of the plane which it has ordered for utility transport work. USAF work with plane showed new speeds and knots possible without structural strengthening and other changes, and so is said to be operating the plane in violation of its re-configuration with operational version, new speed recommendations and load situations were presented to CAA which approved them for commercial operation in 1968.

Cessna Plan Eases Demonstrator Terms

Wichita-New type of demonstrator lease plan designed to permit more operators to take an responsibility of a demonstrator will be made available about Oct. 1 in Cessna Aircraft Co.

The plan, which will be handled by National Aero Finance Co., a wholly owned subsidiary, will allow dealers to purchase demonstrators at a lower initial cost and with lower monthly payments.

Using a \$50,000 model 172 as an example, the dealer would purchase the airplane for \$500 down, the balance paid off over 24 months starting at \$245 the first month and decreasing slightly each month thereafter. Balance of the note is due at the time of the twenty-fourth payment.

Helicopters Used for Industry Rush Cargo

Pittsburgh, Pa.-Helicopter service using a Bell 120 helicopter provided by Industrial Helicopters, Inc., handled its first emergency shipment from a new roofing helipad at Westinghouse's East Pittsburgh plant. The shipment, a replacement lighting fixture for its life size Power Co., was rushed to the Greater Pittsburgh Airport for transfer to an airliner.

The helicopter service from Westinghouse can handle shipments up to 100 lb. Cargo is carried between the landing gear and is in two halves attached to helicopter's side.



Takeoff Assist

To get fully loaded Douglas "on the way" quickly when the motor is given, operator Gordon Marshall, Pittsboro, Mass., developed notepad low cost using a 10 hp Kohler-Morley engine. Two male wheels automatically when engine reaches 50 mph.

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201 E. 43rd St., New York 17, N. Y.



TEMPERATURE-COMPENSATING NETWORKS		BENDIX ELECTRONIC CHARACTERISTICS		EXTREME PERFORMANCE CHARACTERISTICS	
	Induction motor generator	Rated voltage	115 volts 400 cycles	Rated output of test	0.25 mW
		Output voltage gradient	2 volts per 1000 rpm	Operating temperature range	0°C to 100°C
		Output voltage	0 volt to 500V at 2000 rpm	Weight	1 kg
		Phase shift	0 to 3.5 degrees	Test generator	10 mW
				Operating network	10 mW

Eclipse-Pioneer Division

TECHNOLOGY



First Redstone Unit Completes Its Training

Montreal, Ala.—Redstone missile is scheduled to become the basic weapon of an operational Field Artillery unit here this week for the first time. This unit, the 40th Field Artillery, Missile Group (Heavy), will complete its training cycle at the Army Ballistic Missile Agency and then be prepared for deployment overseas. Firing elements of the new unit have begun on training at ABMA since April 1956.

The Redstone missile unit is described by the Army as being in the "evaporation stage." This phase comes between the development and deployment periods.

The unit group is essentially responsible for the missile from reception to checkout. Troops along the Red stone will receive schooling from people who have had considerable knowledge of the weapon.

First production Redstones will be sent to the Redstone Arsenal. There the same ABMA personnel who have headed the complete test program in this will inspect, test and use the components and complete missile before it is sent to operational units. Some of this work will be a double check on inspection and tests during manufacture but it will make certain that each missile is ready for troop use.

Systems also serve a purpose in the development phase. The test people will have experience on a larger number of missiles from which to calibrate, inspect and adjustment techniques to make a factor type also, will become possible. The goal is eventually to be able to support and adjust a missile in the factory so that it can be shipped directly to a field unit for immediate use.

North American Plans Shutdown at Fresno

Fresno, Calif.—North American Aviation will close its Fresno Division by the end of the year when work on jet aircraft, modifications of F-106, is completed.

Canceled defense spending has caused a decline in aircraft modification work and has made it impossible to find enough business to keep the plant in operation. W. H. Yahn, general manager of the plant said:

"A number of contracts on which we have been low bidder have not been awarded because of government fund disbursement problems," Yahn said. "In addition, our studies indicate future aircraft modification business would not justify maintaining our Fresno facility." The 11,000 employees will be laid off at an approximate rate of 600 a month.

MICRO-BEARING ABSTRACTS

By A. H. GAMMA, President
New Hampshire Ball Bearings, Inc.



CONTACT ANGLE



Contact angle is the angle between a plane perpendicular to the bearing axis and a line connecting the two points on a given ball where the ball makes contact with the raceways when the bearing is subjected to any thrust load. In Fig. 1, the contact angle is represented by angle α . The perpendicular of the contact angle is revealed by an extension of the forces present, as a thrust loaded bearing.

In Fig. 2, a simplified version of Fig. 1, the shaft and inner race components are represented by the planes, the "rolling diameters" of the balls and represented by the radii shown as r_1 and r_2 , and the outer race is represented by the tapered ring r_3 .

The contact angle is α . This diagram represents a three-dimensional structure with many equally spaced balls. As the balls are in contact with the raceways, each ball is pressed against the raceways. This force can be calculated by constructing a perpendicular of forces as shown in Fig. 3.

The outer r_2 and r_3 are constant, and diagonal d is the contact angle of T and R . Furthermore, the sum of the thrust components on all the balls results the total thrust and on bearing. The contact angle of the axial component on all the balls is zero. Vector R , the thrust directly felt by the inner and outer balls, compared to vector T , the thrust component, varies directly with changing in the size of the contact angle and is directly proportional to the thrust load component. It is directly proportional to the size of the contact angle.

Example A

A bearing is carrying a pure thrust load of 21 pounds. Assuming seven balls in the bearing, each ball will have an axial thrust component of three pounds, since a thrust load is shared equally by all the balls. While the thrust component on each ball is only three pounds, the actual component force, or vector, felt by the ball and raceway is necessarily greater than this value.

Example B

A bearing is carrying a pure thrust load of 21 pounds. Assuming seven balls in the bearing, each ball will have an axial thrust component of three pounds, since a thrust load is shared equally by all the balls. While the thrust component on each ball is only three pounds, the actual component force, or vector, felt by the ball and raceway is necessarily greater than this value.

With a contact angle of five degrees:

$$\alpha = \frac{T}{R} = \frac{3 \text{ lbs.}}{3.45 \text{ lbs.}}$$

or $\alpha = 5^\circ$

Thus, one thrust with a five degree contact angle the actual load felt by each individual ball is actually approximately greater than the total 21 pound thrust load as the bearing.

Example C

Using the thrust loadlines in Example 1, the contact angle measured is 20 degrees, by substituting a bearing with a larger value of radial play:

$$\alpha = \frac{3 \text{ pounds}}{\sin 20^\circ} = 8.79 \text{ pounds}$$

A 15 degree increase in contact angle produced a 74.5% reduction in ball to raceway contact stress. This relationship should be noted by anyone who writes bearing specifications. The standardization of the bearing, such as low running and starting torque and bearing life, are a function of the ball to raceway contact stress. Thus the contact angle is highly significant.

It is not necessary for a bearing user to calculate or specify the contact angle directly. It is only necessary to remember that low values of contact angle are associated with low radial play, and high values of contact angle are associated with high radial play. In addition to the above considerations, an early factor because of its very important function in determining design contact angle is ball speed.

A more complete discussion of contact angle is found in our design handbook.

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If you wish with maximum benefit, you'll find this new, 70-page authoritative publication a great help in solving problems in designing and selecting to suit your application.

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Send for New Hampshire Ball Bearings, Inc., Peterborough 1, N.H.

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Engineering facts like the Achever contribute to AC's position of leadership in this complex field of electro-mechanical research and engineering. They account, too, for AC's position as a prime contributor in guidance work for the Air Force in the field of advanced missile systems. Or trying top priority from theory right into production, AC sheds reality.



THE ELECTRONICS DIVISION

OF GENERAL MOTORS

FORT MYERS, FLA. DETROIT, MICH. WARREN, MICH.



Loading of X21-40 into C-124B the first time took three hours. With experience, now loaded for return trip in 12 hrs.



Three Transport Types Can Airlift Bell XH-40

Airlift of Bell XH-40 in three different Air Force transports illustrates the air transportability of the new tandem helicopter design. XH-40 was airlifted to Edwards AFB in a C-130 (left and below, right). It returned to Bell's Ft. Worth plant as a C-119. Helicopter was transported to Ft. Rucker, Ala., and back as a C-124 (above and below, left).



New positions in:

MISSILE SYSTEMS AERODYNAMICS

Weapon systems management activities at Lockheed's Palo Alto, Sunnyvale and Van Nuys organizations call for major achievement in aerodynamic areas such as: Theoretical and experimental investigation of the aerodynamic characteristics of missiles at Mach numbers through the hypersonic range; optimization of controlled missile performance; specification and supervision of experimental aerodynamic investigations required to verify and improve missile and weapon system design; analysis and interpretation of aerodynamic flight test data. Inquiries are invited. Please address the Research and Development Staff, Palo Alto 17, California.

Have members of the Aerodynamics Staff discuss during briefing of jet control surfaces. Left to right: W. E. French, thermodynamic advisor; M. Tucker, Aerodynamic Development Group; R. L. Nelson, group aerodynamicist; R. W. Marsh, aerodynamicist; J. J. Osborne (back to camera), aerodynamicist.

Lockheed

MISSILE SYSTEMS

A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

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Firestreak Has Beveled Nose

Most sophisticated missile shown at Fairbrough (AW Sept. 8, p. 26) was the Havilland Firestreak which uses infrared homing. Though beveled nose differs, as does weapon station—its nozzle is Puker Videometer in design, excepting solid propellant rocket used as a boost initially and powered with liquid-firing turbine, rocket and guidance packages at nose and tail. Missile later is mounted on DH Sea Vixen. Other Firestreak installations are on English Electric P.1 and Glorier (AW, Sept. 8, p. 26).

USAF Contracts

Following is a list of awarded contracts for \$25,000 and more as released by Air Force contracting offices.

RAIL INCREMENTAL EFFICIENCY TRAIN, AFRL-113
Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

WALTER BROWN AND SONS, INC., 1001
Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

COLUMBIA RESEARCH CENTER, 1001
Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Argonne, at University of California
Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

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Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

VIA FORGE REPAIR TEST CENTER
Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.

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Ball Point Co., Pasadena, Cal., development project service for Ball Point Co., AF 33-000-000-000-000.



Comet IVs Take Shape

Fourteen for de Havilland Comet IVs for British Overseas Airways Corp. are assembled at Woodstock's Hatfield plant. Five are visible in background on assembly table. Sixth, in background, has left track for equipment bay. No 7 of the four jet transports has gone to working shop.

Average assembly time and labor cost—wired built vs
SPS aircraft bolt with built-in Nylok element



The old wing—with lockwashers



SPS aircraft bolt with Nylok

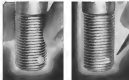
New SPS self-locking bolts with Nylok* reduce assembly time and labor cost 85%

Separate locking devices eliminated

Only one operation is required to finish aircraft assemblies with SPS self-locking bolts. Installing the bolts. No lockwashers, cotter pins or nuts are necessary. The built-in Nylok locking collar forces mating threads together and locks tight. You save the cost of separate locking devices and, far more important, the time and labor it takes to install them. The saving in the case of a wired assembly is 85% by itself. SPS engine and airframe bolts with the built-in Nylok locking element also help you reduce maintenance costs. Dismantling a wired installation, for example, involves cutting the wire, removing fragments, and finally removing the bolts. With SPS self-locking bolts there is again only one step—removing the bolts. Because of the "plastic memory" of the nylon collar, these self-locking bolts can be reused at least 15 times—generally more. They still retain full locking power in spite of violent vibrations.

All externally threaded SPS aircraft fasteners are available with the Nylok self-locking element. For complete information, write Aircraft Products Division, Jenkintown Pennsylvania 19034, Co., Jenkintown, Pa.

CIA Reg. 55. For GDS, the Nylok Corporation



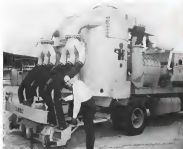
BEFORE ASSEMBLY. The nylon collar projects slightly. When inserted, it locks. It will be engaged into it. The tough, resilient collar forces mating threads together, locks accurately wherever working stops.

AFTER REMOVAL. "Plastic memory" of the nylon collar lets it expand to its original shape. It can be reused repeatedly. It can be used repeatedly. It can be used repeatedly. It can be used repeatedly.

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Standard Product Div. Co. • The Cleveland Car Screw Co. • Crown Friction Products • Benda Carrels, Inc. • Benda Sinter Iron Co., Ltd.

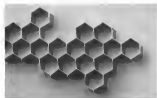


Hustler Runway Cleaner

This versatile runway cleaning device, called JARC for Jet Aircraft Runway Cleaner, is now in operation at General's Post World airport. Primary job is to clear debris from runways, taxi areas and ramps prior to flights of the expensive B-57 Hustler bomber. Machine, which will clean a smooth eight foot wide at about 25 mph, does the job previously requiring 30-40 men and days of labor. JARC was manufactured by U. S. Hoffman Machinery Company, Riverport, N. Y.

After assembly (PS 170-8-114) 1047, 1048, 1049-1050

ROVER AFR, Dallas AFR 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12, 5-13, 5-14, 5-15, 5-16, 5-17, 5-18, 5-19, 5-20, 5-21, 5-22, 5-23, 5-24, 5-25, 5-26, 5-27, 5-28, 5-29, 5-30, 5-31, 5-32, 5-33, 5-34, 5-35, 5-36, 5-37, 5-38, 5-39, 5-40, 5-41, 5-42, 5-43, 5-44, 5-45, 5-46, 5-47, 5-48, 5-49, 5-50, 5-51, 5-52, 5-53, 5-54, 5-55, 5-56, 5-57, 5-58, 5-59, 5-60, 5-61, 5-62, 5-63, 5-64, 5-65, 5-66, 5-67, 5-68, 5-69, 5-70, 5-71, 5-72, 5-73, 5-74, 5-75, 5-76, 5-77, 5-78, 5-79, 5-80, 5-81, 5-82, 5-83, 5-84, 5-85, 5-86, 5-87, 5-88, 5-89, 5-90, 5-91, 5-92, 5-93, 5-94, 5-95, 5-96, 5-97, 5-98, 5-99, 5-100, 5-101, 5-102, 5-103, 5-104, 5-105, 5-106, 5-107, 5-108, 5-109, 5-110, 5-111, 5-112, 5-113, 5-114, 5-115, 5-116, 5-117, 5-118, 5-119, 5-120, 5-121, 5-122, 5-123, 5-124, 5-125, 5-126, 5-127, 5-128, 5-129, 5-130, 5-131, 5-132, 5-133, 5-134, 5-135, 5-136, 5-137, 5-138, 5-139, 5-140, 5-141, 5-142, 5-143, 5-144, 5-145, 5-146, 5-147, 5-148, 5-149, 5-150, 5-151, 5-152, 5-153, 5-154, 5-155, 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WHO'S WHERE

(Continued from page 27)

Changes

John E. Hicks, assistant to the general manager, Fordell Guided Missile Division Fordell Engine and Airplane Corp., Woburn, N.Y.

Alfred J. Rickett, manager manufacturing engineering, Delta Vista Co., Belmont, Calif.

Frank J. DeLeon, public relations manager, Scientific Systems Division of United Technology Corp., Northford, Conn. The Santa I Scientific has joined Scientific Systems.

Robert E. Hines, chief electronic equipment engineer, division of General Dynamics Corp., San Diego, Calif. also headed H. Diggins, special assistant, General Dynamics, San Diego.

C. Gordon Lloyd, general manager, Space Division Components Dept., General Electric Co., Avon, N.Y.

Thomas L. Winter, manager early stage development, Space Systems Group, General Dynamics Corp., Cape Canaveral, N.Y.

Leonard H. Sorenson, manager products sales engineering department, Clear Electronics Inc., Boston, N.Y.

Ulfred F. Muehlen, project engineer IUC program group, Wm. S. Whittier Co. Ltd., Los Angeles, Calif.

Dr. Charles H. Lane, chief of advanced design electronics department, Hamilton Standard Division of United Aircraft Corp., Windsor Locks, Conn.

Marvin Roe, atmospheric missile engineering manager, and Technical Fellow, missile manager, Missile Development Division, North American Aviation Inc., Downey, Calif.

R. E. Garrett, shipping and receiving department manager, North American Aviation Inc., Downey, Calif.

J. Allen Macken, assistant group manager, Product Analysis Corp., South Bend, Ind.

William Sutton, sales manager, J.C. Carter Co., Costa Mesa, Calif.

Joseph H. Ballard, technical product development manager, Vulcan Chemical Division, Ray-Warner Corp., Germantown, Md. Varko J. Gray, head marketing program, DuPont Scientific Co., Greenville, Calif.

Edward R. McGee, sales engineer, Spaceborne Division, Avco Electronics Products Inc., Woburn, Mass.

Richard A. Brown, manufacturing engineering manager, Scientific Systems Division of United Technology Corp., Northford, Conn.

James Allen, director engineering services, General Data Corp., Minneapolis, Minn.

William V. Quigley, controls manager, Chemical Research Unit Co., Cleveland.

William E. Warden, manager assembly, Pacific Coast Division, L.O.F. Glass Plant Co., Berkeley, Calif.

Dr. M. W. P. Shumberg, chairman high speed assembly committee, Avco Electronics Inc., Conshohocken, Mass.

Raymond Dorn, project chief engineering, III Electronic Systems Area, General Dynamics Corp., San Diego, Calif.

Anthony Dubicki, chief application staff, missile control and command, The Walcott Instrument Co., division of F.G. Hayck & Son, Huntington Station, N.Y.

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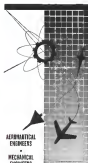
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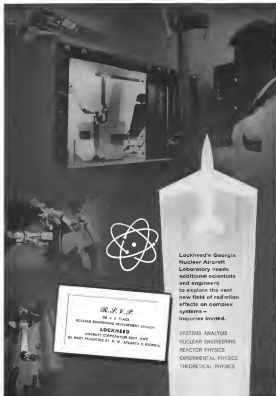
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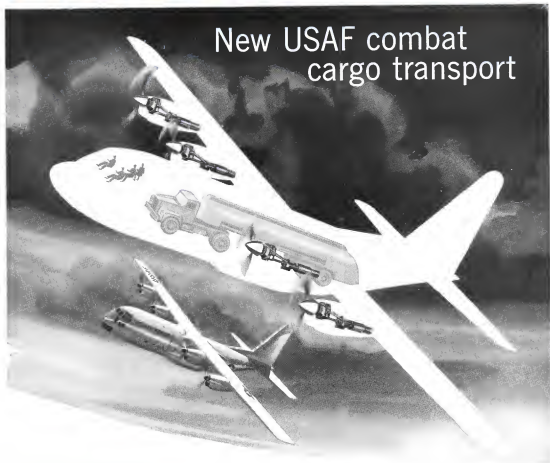
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